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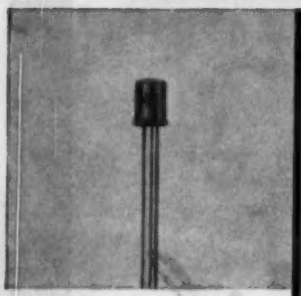

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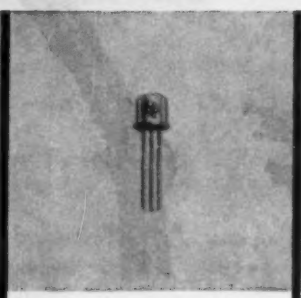

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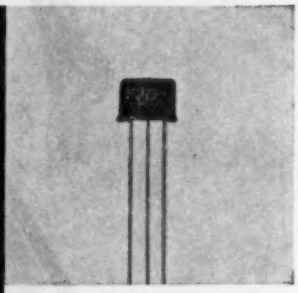

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ELECTRICAL ENGINEERING ABSTRACTS

Volume 63 **NOVEMBER 1960** **Number 755**

GENERAL

(For abstracts on circuit theory see also Lines . Networks . Filters)

614.898 : 621.311.25

6536 **ASPECTS OF THE CONTROL OF RADIATION EXPOSURE.** D.J.Mathias and J.R.A.Lakey.
G.E.C. atomic Energy Rev., Vol. 2, No. 3, 172-6 (Spring, 1960).

Comparatively simple modifications which have been made to standard X-ray machines to enable weld-radiography to be carried out at nuclear power stations safely and conveniently are described. An indication is then given of the types of hazard likely to be encountered during operation of a station, with a discussion of the general principles for dealing with them.

621.3.011

6537 **A CRITERION FOR THE UNIQUENESS OF SOLUTIONS OF THE MAXWELL EQUATIONS.** P.Poincelet.
Ann. Telecomm., Vol. 15, No. 3-4, 77-83 (March-April, 1960). In French.

It is pointed out that cases often arise in electromagnetic field theory where a particular solution can be found and the question then arises as to whether this solution is in fact unique. A method of answering this question is suggested and illustrated by means of typical examples. V.G.Welsby

621.3.011

6538 **ELECTROMAGNETISM, STERADIANS, AND RATIONALIZATION.** E.Perucca.
Atti Accad. Sci. Torino I, Vol. 94, No. 3a, 237-53 (1959-60). In Italian.

The factor 4π occurring in unrationalized systems of units is interpreted as a solid angle and not as a pure number. A new system is proposed in which solid angle appears explicitly as a physical dimension. An extensive table of the dimensions of physical quantities is given, the units of length and solid angle being the metre and the steradian. R.A.Newing

621.3.013

6539 **THE THEORY OF THERMODYNAMIC EFFECTS IN THE ELECTROMAGNETIC FIELD.** L.Kneissler.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 8, 165-70 (April 15, 1960). In German.

In this analysis the thermodynamic equations governing the flow of heat through the medium are combined with the Maxwell field equations in an attempt to obtain a general theory covering the simultaneous propagation of heat and electromagnetic waves. V.G.Welsby

621.3.013.2

6540 **AN INTEGRATION METHOD OF CALCULATING THE FLUX DENSITY IN AN INFINITELY LONG CURRENT CARRYING COIL HAVING ANY CROSS-SECTION.** H.Önal.
Bull. Tech. Univ. Istanbul, Vol. 12, No. 12, 59-67 (1959). In German.

The calculation is carried out by first obtaining an expression for the field due to an infinitesimally short current element, whose width is equal to the length of the coil, and then integrating round the surface of the coil. V.G.Welsby

621.3.081.5

6541 **THE OERSTED AND OTHER MAGNETIC UNITS.** G.Oberdorfer.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 12, 288-92 (June 15, 1960). In German.

A discussion of systems of units. It is concluded that the Oersted, which was introduced as part of a three-unit system, has no counterpart in the modern rationalized four-unit system, in which the unit of magnetic intensity is the A/m. V.G.Welsby

POWER RESOURCES
PRIME MOVERS

620.9

6542 **METHODS USED FOR A RAPID APPRAISAL OF THE HYDRO POTENTIAL OF THE PEACE AND LIARD RIVERS IN WESTERN CANADA, COVERING 84 000 SQUARE MILES.** T.Ingledow.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_2/8$, 22 pp.

The vastness and inaccessibility of the project area, and the limited time available to complete a preliminary appraisal of hydro-electric power potential in a remote northern section of British Columbia, Canada, required unusual speed and mobility in the field. Site examinations by helicopter, barometric levelling for vertical control, air transport of supplies, ample use of photography, and pre-planned note-taking methods were employed to permit establishment of approximate gradients on 28 streams and physical examination of 170 dam-sites in only one short field season. The evaluation survey is only a first step in the determination of actual hydro-electric potential of the project area. However, the results indicated several attractive schemes for more detailed investigation at some future date. One of the schemes, that on the main Peace River, has already been subjected to further investigation.

620.91

6543 **PASSAMAQUODDY HARNESSING TIDAL POWER FOR ENERGY.** J.W.Leslie.
World Pwr Conf. Sectional Meeting (Madrid, 1960) Paper II B/1, 21 pp.

620.91

6544 **SOME COMPARATIVE CONSIDERATIONS ON THE ECONOMICS OF PUMPED STORAGE SCHEMES USING PUMP-TURBINES AS AGAINST SEGREGATED MACHINES.** E.J.Meier.
World Pwr Conf. Sectional Meeting (Madrid, 1960) Paper II B/2, 23 pp.

Deals first with the possibilities of application of pumped storage schemes in large grids. Three types of such plants, depending upon the length of periods for storage, are defined. Some examples of installations in operation for low, medium and high heads are given. In this respect, the first reversible machine, which was installed in 1933 at the Baldeney power station in Germany, is recalled. Test results made with pump models also working as turbines are given. These results show the technical difficulties in developing reversible machines with high efficiencies under both operations. A way of surmounting these inconveniences is indicated. By comparing the possible solutions with reversible machines as against those with separate pumps and turbines, the hydraulic, electrical and operational problems which both alternatives present are dealt with. Some economic considerations in this respect, such as the evaluation of efficiency and the thermal competitors of pumped storage schemes are treated. The conclusion is drawn that owing to the interconnection of national grids, waste electric energy is no longer available for pumping and that the overall efficiency of any storage scheme accordingly plays an important role in the economy. Only a detailed study of each separate case will provide the answer to whether thermal peak units, or hydraulic storage schemes with reversible machines, or with the conventional arrangement of separate pumps and turbines, will be most economical solution.

620.91

6545 UTILIZATION OF LONG TERM STORAGE IN COMBINED HYDRO AND THERMAL POWER SYSTEMS. S.Stage and Y.Larsson.
World Pwr Conf. Sectional Meeting (Madrid, 1960) Paper II B/3, 10 pp.

In power systems comprising hydro and thermal plants, the way in which the long-term storage reservoirs on the developed rivers should be utilized is to a great extent dependent on the proportion between these two types of power. However, a common rule is that when the amount of storage is below a certain definite limit, which is given at each time of the year, the discharge should be confined to a certain definite minimum necessary for supplying only that part of the load which cannot be met by the thermal plants of the system. The purpose of this rule is to ensure that this minimum discharge shall be maintained even in case a long dry period were to follow. When the amount of storage is above this limit, the discharge from the storage reservoirs is determined by the expected incremental value of the stored water. A method for the calculation of this value by means of a rapid digital computer is presented.

620.91

6546 UTILIZATION OF THE ENERGY RESOURCES OF THE LOWER VISTULA. THE PROBLEM OF APPLICATION OF TUBULAR PUMP-TURBINES. K.Jackowski, E.Koban and A.Laski.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIB/5, 15 pp. In French.

Discusses the importance of the Lower Vistula as the greatest source of water power in Poland. It gives the characteristics of the river and the project for its development by the system of 9 dams in cascade, in two variations: one conventional, another based on the new conception proposed by "Hydroprojekt" Warsaw in order to increase the degree of utilization of water-power resources. This is achieved by replacing the conventional arrangement by a system of peak-power plants with their own inflow and pumped storage. For this purpose the construction of power stations equipped with pump-turbines analogous to those used in tidal power plants is projected. This variant of the conventional one allows installed capacity and power production (especially peak-power production) to be increased, while simultaneously diminishing the cost per MW installed, for each power station as well as for the whole system.

620.91 : 621.357

6547 POWER NEEDS AND THE SITING OF ELECTRO-CHEMICAL PLANTS NEAR POWER SOURCES. C.Castellani.
World Pwr Conf. Sectional Meeting (Madrid, 1960) Paper II B/6, 10 pp. In French.

An examination of the energy balances of many countries shows that the geographical distribution of the energy sources does not correspond to the industrial development of each country. The inference is that it would be advantageous to exploit conventional energy sources already proved by locating some types of electro-chemical factories near the sources still unexploited and able to produce energy at a very low cost. In the particular case of Italy, where the energy availability position is rather critical if compared with future requirements, the possibility is envisaged of setting up some electrochemical plant, mainly those for aluminium production, with the aim of exploiting "in situ" the energy sources still available in Italy or abroad. Some past and some quite recent examples of initiatives for manufacturing, in the vicinity of energy sources, some products having a high specific energy content such as aluminium, whose transportation cost is lower than the cost of the energy it contains are quoted.

620.91

6548 COORDINATION OF THE USES OF WATER FOR POWER AND AGRICULTURE, AS A MEANS FOR REDUCING THE COST OF ELECTRICAL ENERGY. J.G.Moyrón.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIB/12, 9 pp. In Spanish.

In view of the great importance, both quantitative and qualitative which is being acquired in Spain by hydroelectric production from dams built for agricultural purposes or water supply, it is proposed that the cost of these control works should be shared, not only by direct industrial users as heretofore, but also by direct agricultural users and by all kinds of indirect users who benefit by such works. The belief is expressed that a system of hydro-power tariffs based on the idea of large catchment areas (which accords with Spanish physical geography) would largely reflect the drop in price of hydro-power produced in foot-of-dam plants at these regulation works.

620.92

6549 METHODS OF INVESTIGATING HYDROELECTRIC ENERGY POTENTIAL ON MULTIPLE-PURPOSE RECLAMATION PROJECTS. F.E.Dominy.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper $IA_3/1$, 19 pp.

Although the Bureau of Reclamation, an agency of the United States Department of the Interior, is engaged primarily in irrigation development, it has become one of the largest producers of hydroelectric power in the United States. Hydroelectric power plants on Bureau of Reclamation projects in the Western United States have a total installed capacity greater than 5 000 000 kW. These hydroelectric installations are frequently associated with multiple-purpose development projects, and the use of water for other purposes, such as irrigation, flood control, industrial and municipal water supplies, preservation and propagation of fish and wild life, and other important functions, must be carefully integrated with the power aspects of the projects. This paper discusses the methods of investigating and evaluating hydroelectric potential of such multiple-purpose projects and the considerations entering into the determination of hydroelectric project feasibility in the plan formulation.

620.92

6550 INVESTIGATION OF HYDRO POWER RESOURCES IN SWEDEN. E.Blomqvist and K.A.Scherman.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_3/3$, 26 pp.

Hydrographically, Sweden is rich in rivers and lakes. The number of rivers with a larger catchment area than 1000 km^2 is 45 and, of these, 15 have an area larger than 10 000 km^2. The number of mapped lakes is almost 90 000 of which 26 have an area in excess of 100 km^2. In general, the height of fall of Swedish rivers is relatively slight and, in consequence, it is not usually possible to achieve a greater head than some tens of metres at any given power-station site. The average height of the country is 320 metres. Hydrographic observations and measurements have been carried out on quite a large scale over the past fifty years. Comprehensive calculations of the country's total assets in the form of water power indicate that this natural asset amounts to some 200 000 MkWh per annum, or about 165 000 MkWh of harnessable energy. It is estimated that about half of this amount, or around 87 000 MkWh, is economically harnessable. To date about 33 000 MkWh has been exploited. The current expansion programmes refer mainly to river areas — a method which offers great advantages compared with the sporadic exploitation of a number of sites distributed over the river system as a whole. For this reason, regional plans are drawn up prior to the establishment of large power stations. Experience of regional planning has been generally good, even though such planning is associated with considerable cost and requires a great deal of time.

620.92

6551 METHODS OF INVESTIGATION OF NORWEGIAN HYDRAULIC ENERGY RESOURCES.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_3/5$, 7 pp.

The investigation of Norway's water power is subject to the Norwegian Watercourse and Electricity Board and is carried out by the Hydrological Division consisting of three sections, namely: Hydrological Section, Ice Section and Water Power Section. The Hydrological Section gathers and arranges the hydrological material, constructs run-off maps, summation curves, regulation curves etc. The Ice Section investigates the ice conditions in rivers and lakes. Much of this work is field work. The water power is calculated by the formula $P = 8\ Qh$ (kW). where Q equals uniform regulated discharge of 90% probability, and h the gross head.

620.92

6552 COMPARATIVE STUDY OF HYDRO-ELECTRIC RESOURCES AS EXEMPLIFIED BY EUROPEAN EXPERIENCE. A.J.Dilloway.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_3/10$, 15 pp.

Deals with methods of evaluating basic hydro-electric resources in such a way that results for different countries can be compared. Methods discussed are those adopted by the Committee on Electric Power of the United Nations Economic Commission for Europe, and its group of experts for the study of hydro-electric resources in Europe. The main discussion is preceded by a brief reference to methods of comparing economic trends in various European countries with the object of elucidating the effect of the use of hydro power on

development of energy requirements. Methods for comparative study of hydro resources include those for analysis of gross surface potential and its relationship to exploitable potential; determination of gross river potential; the comparison of special regional characteristics over large areas due to year-to-year differences in flow conditions; and common presentation of current flow data to yield information on short-terms changes in hydraulicity. Some questions arising from the use of these methods are discussed.

621.165 : 621.317.39

NEW INSTRUMENT SYSTEMS FOR RECORDING TURBINE SPEED, ECCENTRICITY, EXPANSION AND VIBRATION. See Abstr. 5506

621.221.4 : 621.398

SUPERVISORY AND AUTOMATIC CONTROL SYSTEM FOR WINNIPEG UNATTENDED PUMPING STATION. See Abstr. 5901

POWER SUPPLY
POWER STATIONS

621.311.1

6553 NEW METHODS OF ELECTRIC POWER GENERATION. I-II.

Engineer, Vol. 210, 84-6 (July 8); 123-6 (July 15, 1960).

Four unusual methods of electric power generation, employing fuel cells, thermoelectric, thermionic and magnetohydrodynamic generating principles are discussed in detail and some of many different types of fuel cell being developed in laboratories throughout the world are listed. Techniques for d.c. to a.c. conversion are considered. Central Electricity Generating Board Digest

621.311.1

6554 ELECTRIFICATION PLAN FOR THE NORTHEAST OF BRAZIL. C.Berenhauser, Jr.

World Pwr Conf. Sectional Meeting (Madrid, 1960) Paper IIB/16, 16 pp.

621.311.16

6555 A PROCEDURE FOR DETERMINING THE MOST ECONOMIC DISTRIBUTION OF LOAD ON NETWORKS SUPPLIED BY HYDROELECTRIC ENERGY. H.Pozar.

World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIB/13, 15 pp. In French.

Describes a method and gives formulae for finding the most advantageous load allocation among storage-type hydro-power stations, having regard to the limitations imposed by available water. By striking an energy balance between hydro and thermal stations on the basis of reduction in coal consumption, it becomes possible to allocate loads between the two types of power station, provided that minimum generating costs for the given stations are found and transmission losses are taken into account.

621.311.161

6556 SOME PROBLEMS OF ECONOMIC COOPERATION OF HYDRO POWER STATIONS TO COVER PEAK LOADS.

L.Votruba and J.Tvarůžek.

World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper IIB/17, 17 pp.

Analyses the present load diagram of the Czechoslovak electrical-energy system and shows its presumptive future development. Some observations are made on the ways of assessing the economy of interconnecting hydro-stations for meeting peak loads under various service conditions. Analyses the basic economic features of hydro and thermal power stations and assesses their integration into a common system, also from the service viewpoint.

621.311.21

6557 BRAZILIAN WATER POWER FOR ALUMINIUM PRODUCTION.

Elect. J., Vol. 165, No. 7, 381-3 (Aug. 12, 1960).

The Rio Jaquia river is being developed in two stages to provide power for aluminium plants. The first stage, which is already in operation, contains the Cachoeira do Franca underground station which houses two 15 MW sets and has an annual production of 151×10^6 kWh. The second stage, now under construction, will incorporate the Fumaca station which will house two 22 MW sets. Central Electricity Generating Board Digest

621.311.21

6558 THE DESIGN OF THE HINTERRHEIN SCHEME. R.Ribi amd N.Schnitter; H.Schiller; P.Jaray.

Schweiz. Bauztg, Vol. 78, No. 29, 479-86 (July 21); No. 32, 526-30 (Aug. 11); No. 33, 535-8 (Aug. 18, 1960). In German.

The Sufers dam on the Upper Rhine, Switzerland, is an arch dam 58 m high and 125 m long; considerable details on the design procedure are given. Three stations with capacities of 210, 256 and 288 MVA are arranged in series along the river and connected by a 220 kV grid. The top station, Ferrara, contains three sets consisting of a Francis turbine under 522 m head, a 70 MVA 10.5 kV 750 rev/min motor–generator and a 2-stage 5.2 m^3/sec pump. P.Linton

621.311.21

6559 [HYDRO-ELECTRIC DEVELOPMENTS IN] THE RHÔNE VALLEY.

Water Pwr, Vol. 12, No. 6, 215-23 (June); No. 7, 272-9 (July, 1960).

A description of the multi-purpose development of the Rhone between the Swiss frontier and the Mediterranean with particular reference to current schemes in the middle third of the Lower Rhone.

621.311.21

6560 TRASHRACKS AND RAKING EQUIPMENT. I. TRASHRACKS. T.Zowski.

Water Pwr, Vol. 12, No. 9, 342-8 (Sept., 1960).

A review of the principles of design and operation of trashracks and raking devices commonly used in hydro-electric power plants.

621.311.21

6561 THE YANHEE MULTIPURPOSE PROJECT. B.L.Robinson.

Water Pwr, Vol. 12, No. 9, 352-8 (Sept., 1960).

The significance of this important project in the Kingdom of Thailand is explained and its main features are described.

621.311.21

6562 VARIOUS MEANS OF SECURING MAXIMUM OUTPUT OF EXISTING HYDRO-ELECTRIC FACILITIES AND ECONOMIC DISPATCH OF A HYDRO-STEAM SYSTEM.

I. I.Deguise, N.F.Macfarlane and D.King.

II. F.C.Lawson and R.D.Nevison.

World Pwr Conf, Sectional Meeting (Madrid, 1960) Paper II B/4, 24 pp.

The first section deals with the methods employed by three large utilities in the Province of Quebec to obtain maximum output from their existing hydro-electric facilities. While the report is presented in general form, it mainly concerns practices of the Quebec Hydro-Electric Commission, the Aluminum Co. of Canada and the Shawinigan Water and Power Co., whose combined hydro-electric generating facilities total 7½ million kilowatts. The problem is approached by four means: (1) ulitizing more water; (2) increasing net head; (3) increasing efficiency; (4) increasing machine capacity. The second section indicates how a mixed hydro-steam system may develop from an all-hydro system and how this pattern of development affects the approach taken toward economic dispatch of the system generation. The existing theory of economic dispatch is discussed from both the short term and long term aspects and a distinction between these two categories is defined. An approach to the short term problem, called the co-ordination equation method, is presented together with a method proposed by various authors for the solution of the long term problem. Some results of investigative studies made by Ontario Hydro using the co-ordination equations for the short term economic dispatch of four hydro and three steam plants are given. The indicated savings when system conditions are propitious range from $200 to $800 per day.

621.311.21

6563 SOLUTION OF SOME PROBLEMS OF HYDROELECTRIC DEVELOPMENT OF THE INTERNATIONAL STRETCH OF THE DOURO, IN THE ZONE RESERVED FOR PORTUGAL.

F.G.Henriques and R.Preza.

World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper IIB/10, 27 pp. In French.

621.311.21

6564 SOME ASPECTS OF THE PLANNING OF PUMPED-STORAGE PLANTS WITHOUT NATURAL INFLOWS.

K.Haager, F.Hartmann and O.Uitting.

World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIB/11, 25 pp.

Pumped-storage plants without natural inflows can be installed

wherever adequate heads are available. Topographical and geological conditions have a decisive influence on the civil engineering work of the scheme. This applies in particular to the material to be used for sealing the upper and lower reservoirs. Depending upon the topography of the site, either penstocks or pressure tunnels should be favoured to carry the water. Pressure tunnels should be reinforced by concrete or steel linings and by injection into the rocks. Equipment is of two types: (1) sets comprising separate pumps and turbines, the pump being usually coupled to the motor-generator through a clutch or a synchronizing torque converter which acts as a hydraulic clutch. Francis-type turbines can at the present state of technology be designed to accommodate heads up to 600 m. (2) reversible pump-turbines for operation under heads up to about 150 m. If good efficiencies are to be obtained, in either pumping or generating sequence, such pump-turbines must be designed for two-speed operation. A modern pumped-storage plant attains an overall operating efficiency of 70% and above. With reversible pump-turbines this efficiency is only slightly below this value. The efficiency, however, drops appreciably when the power station operates at a low load factor.

621.311.21

6565 METHODS OF REDUCING HEAD LOSSES IN REGULATION OF RUN-OFF IN POWER STATIONS.

P.G.Shenguelia.

World Pwr Conf., Sectional Meeting (Madrid,1960) Paper IIB/14, 9pp.

In storage regulation of mainstream run-off, losses of head occur in the backwater section. The amount of energy thus lost may, in a number of cases, be as high as 25 per cent or even more, of the annual output of a hydro plant. Losses of energy occur in short-term regulation of run-off as well. In many cases utilization of a considerable part of lost head is technically possible and economically advisable. Means of utilizing this head in certain cases are discussed and appropriate methods of compiling water-power and economic estimates are proposed. Some results of estimates, made for certain chains of hydro plants and for single installations designed for mountain rivers, are given.

621.311.22

6566 'ONCE-THROUGH' SUPER-CRITICAL BOILER AND TURBO-GENERATOR.

Elect. Rev., Vol. 166, No. 25, 1161-3 (June 17, 1960).

A 240 klb/hr Benson boiler, with outlet steam conditions of 3300 lb/in^2 and 1060°F/836°F reheat and a 9.5 MW back-pressure turbo-generator, with steam conditions at the t.s.v. of 3000 lb/in^2 and 1050°F have recently been installed at the Margam Works of the Steel Company of Wales. The output of the boiler can be obtained when burning either blast furnace gas with a calorific value of 92 B.t.u/ft^3 at 32°F and 30 in.Hg or fuel oil of 18 000 B.t.u./lb. grade. Central Electricity Generating Board Digest

621.311.22

6567 TURBO-GENERATOR SEQUENCE CONTROL.

Elect. Rev., Vol. 167, No. 5, 169-73 (July 29, 1960).

Switches in the control circuits of two of the four 60 MW turbo-generators installed in the South Denes, Yarmouth, generating station enable the sets to be started and stopped semi-automatically in a series of interlocked stages. The normal operating sequence is employed , the single switch controlling the supplies to the set auxiliaries, pumps, motorized valves, etc. Automatic oil-burner control is provided.

621.311.22

6568 BLYTH A POWER STATION.

Elect. J. Vol. 165, No. 1, 32-4 (July 1, 1960).

The station includes four 120 MW turbo-alternators supplied with steam at 1600 lb/in^2 and 1010°F; four reheat boilers each of 860 000 lb/hr capacity are installed together with p.f. equipment, the whole being under automatic combustion control. Details are given of the principal mechanical and electrical data for the station.

M.Rathbone

621.311.22

6569 MOVING COAL FROM PIT TO POWER STATION.

Elect. J., Vol. 165, No. 7, 384-5 (Aug., 1960).

Coal is to be transported direct from the Lea Hall colliery to the 600 MW Rugeley power station. The plant installed, and the coal transport systems at the colliery are described.

Central Electricity Generating Board Digest

621.311.22

6570 THE 360-MW STEAM POWER STATION FOR ELEKTRIM, WARSAW, WITH SPECIAL REFERENCE TO THE FIRST STAGE OF CONSTRUCTION WITH FOUR 55-MW UNITS. H.Scheidt.

Siemens-Z., Vol. 34, No. 7, 410-21 (July, 1960). In German.

The 360-MW steam power station for Elektrim, Warsaw, was equipped with four 55-MW turbo-generator sets in the first stage of construction and with two 70-MW reheat units in the second. It is one of the most economical power stations in Poland. The turbo-generator sets of the first stage can be synchronized both by the conventional fine method and by the coarse method. A description is given of the layout and equipment in the first stage of construction of the power station.

621.311.25

6571 DUNGENESS NUCLEAR POWER STATION.

Elect. Rev., Vol. 167, No. 4, 129-31 (July 22, 1960).

The reactors for the 550 MW Dungeness nuclear power station will be of the gas-cooled graphite-moderated type with natural uranium fuel bars clad in magnox sheaths. Steam will be generated in the four boilers associated with each reactor at two pressures, 1418 and 590 lb/in^2. The two identical reactor units will each have an thermal output of approximately 840 MW. Steam conditions at the t.s.v. will be 550 lb/in^2 and 391°C. The overall station efficiency at these conditions will be 32%. The cost of the station, which is due to be completed in 1965, will be approximately £110/kW sent out.

Central Electricity Generating Board Digest

621.311.25

6572 HEALTH SAFEGUARDS IN NUCLEAR POWER STATIONS. G.R.Bainbridge and B.C.Godbold.

Elect. Rev., Vol. 167, No. 10, 369-74 (Sept. 2, 1960).

321.311.25

6573 NUCLEAR POWER PROGRESS IN BRITAIN. U.K. ATOMIC ENERGY AUTHORITY'S REPORT, 1959-1960. I-II.

Engineer, Vol. 210, 144-8 (July 22); 171-5 (July 29, 1960).

621.311.25

6574 A 30-MW ADVANCED GAS COOLED REACTOR INSTALLATION. M.Lindfield.

G.E.C. atomic Energy Rev., Vol. 2, No. 3, 129-37 (Spring, 1960).

A description is given of the design and operating procedure of a 30 MW(e) reactor installation. A table of leading parameters is included. The basic design is suitable for electricity generation over the range 20 to 100 MW and is a development of that already put forward for marine propulsion. The reactor is of the graphite-moderated, gas-cooled type, fuelled with slightly enriched uranium dioxide canned in stainless steel to give a high power density.

621.311.25

6575 CONTROL RODS AND ABSORBER IN REACTOR DESIGN. H.T.Richardson.

G.E.C. atomic Energy Rev., Vol. 2, No. 3, 162-71 (Spring, 1960).

A description of the various absorber functions is given, with particular reference to the large gas-cooled graphite-moderated reactor. This is followed by a discussion of the amount of absorber required in each case and of possible physical forms. A full description is then given of the methods used for the calculation of control-rod effectiveness, including a brief treatment of the effects of partial rod insertion.

621.311.25 : 614.898

ASPECTS OF THE CONTROL OF RADIATION EXPOSURE.

See Abstr. 6536

621.311.42

6576 INTERCONNECTION STATION FOR 220 kV SYSTEMS AT CHAMOSON. J.Dietlin.

Bull. Assoc. Suisse Elect., Vol. 51, No. 15, 739-45 (July 30, 1960). In French.

Describes and illustrates one of the most important stations of this kind in Switzerland with particulars of the systems involved and details of ancillary equipment for transformation, switching, and control. Brief notes are included on the lines and cables used and means of measuring voltage, current, and energy dealt with. Methods of installing the various pieces of equipment and rendering them mobile are also discussed. A.P.Pator

ELECTRIC MACHINES

621.313.1

6577 ELECTRICITY MACHINES WITH PRINTED WINDINGS. J.Henry-Baudot.

Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 2-3, 119-38 (Feb.-March, 1960). In French.

Describes a range of small electric motors in which the rotor consists of a disk on which the windings have been printed by a technique similar to that used in radio circuits. These motors have been developed specifically for the operation of servo-mechanisms, and in particular for the operation of analogue computer controls. For this purpose the printed-circuit machines have the following advantages: (1) very low self-induction — hence excellent commutation and a negligible time-constant; (2) low weight — hence low inertia; (3) excellent cooling, allowing current densities of 45 A/mm^2. The resulting torque characteristic and the ability to run completely smoothly at very low speeds make it possible to couple the motors directly to the equipment they operate, and to stop the rotor instantly in any desired position. D.R.Way

621.313.1

6578 EQUATIONS OF ALTERNATING CURRENT ELECTRICAL MACHINES IN PHYSICAL AND RELATIVE UNITS. M.I.Alyab'ev.

Elektrichestvo, 1960, No. 1, 18-26 (Jan.). In Russian.

The advantages and shortcomings are discussed of various systems of units used in machine equations. Analytical data and comparisons for ten systems of units are given, three of which define the machine parameters by physical units, the remainder by means of per-unit values based upon different quantities. Tables are provided for the conversion of data from one system of units to another. J.H.B.Gould

621.313.1

6579 ELECTROMAGNETIC PUMPS FOR LIQUID METALS. A.I.Voldek.

Elektrichestvo, 1960, No. 5, 22-7 (May). In Russian.

621.313.1

6580 FRICTION LOSS IN THE AIRGAP. J.Hak.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 14, 325-8 (July 15, 1960). In German.

An equation for calculating the airgap windage loss in electrical machines is developed for air and hydrogen at various temperatures and pressures. The equation takes account of the roughness of the stator and rotor surfaces. The relationship between the friction factor and the surface roughness due to slot openings is not sufficiently well established to permit exact calculation of the airgap windage loss, but upper and lower limits can be estimated. Numerical examples illustrate the use of the equation for an induction motor and a turbo-alternator. A bibliography is included. H.Sterling

621.313.1

6581 THE APPLICATION OF THE METHOD OF IMAGES TO MACHINE END-WINDING FIELDS. C.J.Carpenter.

Proc. Instn Elect. Engrs, Paper 3327 U, publ. Oct., 1960 (Vol. 107A, 487-500).

Although a variety of methods have been used to calculate the fields associated with the end-windings in rotating electrical machines, there appears to have been little attempt to exploit the method of images. This provides a means of solving the field problem by integration with relatively high accuracy. By making use of the vector potential, a comparatively simple calculation is possible of the flux linkages due to complex end-winding arrays. The image principle is extended in the paper to circuits which are partly embedded in the reflecting surface. The effects of various complexities in the boundary conditions, including the presence of the airgap, are considered. The method is well suited to both turbo-type alternators, with magnetic and non-magnetic end-rings, and to induction motors. It is illustrated by calculating the end-winding inductance of a 2-layer induction-motor winding.

621.313.2

6582 CALCULATION OF THE RISE IN THE COMMUTATING FLUX FOR SUDDENLY APPLIED LOADS. V.A.Yakovenko.

Elektrichestvo, 1960, No. 5, 36-8 (May). In Russian.

Methods are suggested for the calculation of the rise in commutating flux during changes of load on d.c. machines. Three types of load change are examined: instantaneous, exponential, and straight-line change up to a steady-state value. Results of the calculations show good agreement with experimental data. Curves of rise in commutating flux calculated by one of these methods show how far the flux lags behind the load current. It is thus possible to evaluate the commutating properties of a projected machine in transient conditions.

Associated Electrical Industries (Manchester)

621.313.2

6583 CALCULATION OF COMMUTATION REACTION IN D.C. MACHINES. V.V.Fetisov.

Elektrichestvo, 1960, No. 5, 46-9 (May). In Russian.

Reviews the existing methods for calculating the magnetizing force of the commutating reaction in d.c. machines. None of these methods can be used successfully where the brush overlap is greater than unity. A method of calculating the armature reaction is presented which can be used for a brush overlap much greater than unity, and for the usual values of brush overlap. The formulae given can be used for any type of armature winding. 9 references.

Associated Electrical Industries (Manchester)

621.313.2

6584 ELECTROMAGNETIC CALCULATION OF D.C. MACHINES TAKING COOLING OF THE WINDINGS INTO ACCOUNT. N.A.Panfilov.

Elektrichestvo, 1960, No. 5, 50-3 (May). In Russian.

The electromagnetic parameters of d.c. machines are usually chosen so that the magnetic flux corresponds to a saturated condition of the magnetic system. In this case, the maximum output of the machine is not always achieved. To achieve the maximum output it is necessary to determine the optimum magnetic flux. It is shown that this flux must be chosen with allowance for the cooling conditions, the class of insulation, and the speed of the machine. 2 references. Associated Electrical Industries (Manchester)

621.313.223.1-8 : 621-526

6585 VOLTAGE REGULATION OF A SELF-EXCITED D.C. GENERATOR WITH ADDITIONAL EXTERNAL EXCITATION. H.Böddeker.

Regelungstechnik, Vol. 8, No. 4, 124-6 (April, 1960). In German.

By applying a small amount of additional external excitation, the continuous and stable voltage regulation of a self-excited d.c. generator can be achieved. The performance is similar to that of an amplifying system which is subjected to a time constant and dependent on a governing variable. The rate of response of such a system is directly proportional to the applied voltage of the additional external voltage and inversely proportional to the sum of the damping time-constants of the exciter circuits. J.H.W.Arends

621.313.3

6586 THE EQUIVALENT CIRCUIT AND PRECISE CIRCLE DIAGRAM OF A SYNCHRONOUS REACTANCE MOTOR. O.B.Pevzner.

Elektrichestvo, 1960, No. 2, 64-8 (Feb.). In Russian.

It is stated that there is no method similar to that used for the induction motor for calculation of the performance of synchronous reactance motors. An attempt is made to present an analogous method for this type of machine, taking into account the angle of displacement. Equations are developed for the performance from which the equivalent circuit and circle diagram can be obtained. It is thus possible to estimate the output at the shaft under various conditions of load. Tests were made on a motor of 5 W output and close agreement was obtained with calculated performance. It was however found that over-simplification of the parameters had to be avoided and the various leakage reactances must be included.

J.S.Wilson

621.313.3

6587 EXPERIMENTAL STUDY OF NEW METHODS FOR DETERMINING THE PARAMETERS OF A.C. MACHINES. M.P.Kostenko, E.Ya.Kazovskii and Ya.B.Danilevich.

Elektrichestvo, 1960, No. 6, 14-16 (June). In Russian.

New methods of determining the frequency characteristics and other parameters of a.c. machines, and a method of calculating the transients in the machines from the frequency characteristics, have been recently proposed. The results of a detailed experimental investigation of some of the proposed methods are given. The data obtained by means of the new methods are compared with experimental data obtained by other means. It is shown that the new methods are simple and give satisfactory results, particularly in the case of transients in machines with solid elements.

Associated Electrical Industries (Manchester)

621.313.32

6588 ASYNCHRONOUS TORQUES OF A SYNCHRONOUS MACHINE WITH COMPENSATION OF EXCITATION CIRCUIT IMPEDANCE. B.K.Karpenko.
Elektrichestvo, 1960, No. 1, 51-5 (Jan.). In Russian.

A method of raising the value of asynchronous torque is examined, and the results of an experimental circuit are given. In the experimental circuit the alternator excitation was provided by a rotary booster whose control winding was fed from an electronic amplifier which balanced the compensating impedance virtually independently of current. The methods of deriving the compensating impedances and resulting asynchronous characteristics are described, but the exact analytical expressions for critical slip and maximum torque are difficult to obtain, although the form of the calculation shows that the critical slip lies in the region of frequency where the compensation of rotor impedance is a maximum. The value of the compensation-circuit time-constant affects the position of critical slip. The effects of saturation in the circuit elements are considered and a simplified method of determining the maximum extent of swing is suggested. Variation of regulator signal is found to produce a family of asynchronous characteristics between certain definite limits (critical slip 0.04 and 0.24 in the case of the experiment). It is concluded that the method is capable of doubling the asynchronous torque at a power factor near, or even beyond unity. J.H.B.Gould

621.313.322

6589 RECTIFIERS FOR THE EXCITATION OF THREE-PHASE SYNCHRONOUS GENERATORS.
H.Reichmann and Y.Rogowsky.
A.E.G. Progress, 1959, No. 3, 202-8.

English translation of the paper already abstracted as Abstr. 1197 of 1960.

621.313.322

6590 FAST EXCITATION SYSTEMS. LARGE GENERATOR SCHEMES - No. 1, G.E.C. K.C.Parton.
Elect. Times, Vol. 138, 157-62 (Aug. 4, 1960).

Describes the design and site performance of one regulator from the aspects of power system operation and the control requirements. The voltage regulator is fitted with a rotor angle control unit, both equipments being of the magnetic amplifier type; together they provide a comprehensive static excitation system giving continuously acting voltage control with no inherent dead-band. Basic circuit diagrams, oscillograms and frequency-response curves are given with an outline of the theory orginally developed by W.G.Heffron and R.A.Phillips (Abstr. 524 of 1953). J.T.Hayden

621.313.322

6591 STUDY OF OUT-OF-STEP CONDITIONS AND RESYNCHRONIZATION OF A GENERATOR AFTER LOSS OF TRANSIENT STABILITY. M.P.Chesnov.
Elektrichestvo, 1960, No. 6, 21-5 (June). In Russian.

Operating experience and experimental investigations show that, when dynamic stability is disrupted, synchronous operation of a generator is often restored by the action of the voltage regulator and the speed governor of the prime mover. An approximate analytical method is given of investigating the movement of the generator rotor, with allowance for transient conditions, and the possibility of resynchronization.

Associated Electrical Industries (Manchester)

621.313.325

6592 VARIABLE-POLARITY EXCITATION OF SYNCHRONOUS CONDENSERS. N.I.Sokolov.
Elektrichestvo, 1960, No. 5, 28-31 (May). In Russian.

Considers methods of increasing the consumption of reactive VA in synchronous condensers. In the conditions examined, stable operation of the condensers is only possible with special variable-polarity excitation regulation operating in relation to the phase-shift angle of the rotor. It is shown that the use of an angle regulator during consumption of reactive VA makes it possible to increase the utilization of synchronous condensers by 30-60%.
3 references. Associated Electrical Industries (Manchester)

621.313.322 : 621.316.722

6593 EXCITATION CONTROL SYSTEMS FOR LARGE A.C. GENERATORS. C.B.Cooper and L.R.Girling.
A.E.I. Engng Rev., Vol. 1, No. 2, 75-82 (July, 1960).

The basic elements of a modern excitation control system are described. The factors affecting the operation of a generator beyond the hand-control stability limit are discussed, and the use of an electronic analogue computer to solve the differential equations involved is described. The results obtained from the theoretical investigation are compared with those obtained in field tests.

621.313.333

6594 A.C. STARTER MOTOR FOR INDUSTRIAL GAS TURBINES. F.B.Slocock.
A.E.I. Engng Rev., Vol. 1, No. 2, 83-6 (July, 1960).

An a.c. starter motor is used to start a 5500 kW gas-turbine/generator through an automatic clutch. The motor's design and characteristics and the starting resistance and control gear are described.

621.313.333

6595 DESIGN OF SPHERICAL MOTORS. E.R.Laithwaite.
Elect. Times, Vol. 137, 921-5 (June 9, 1960).

In a previous article (Abstr. 55 of 1960) the spherical motor with 2 stator blocks was described. The rotor surface is part of a sphere, round which the stator blocks with concave surfaces are fitted. A further examination of the theory is made and possible developments are indicated. A bibliography is added.
R.G.Jakeman

621.313.333

6596 ON THE EFFECTS OF VARYING AIRGAP OF A SQUIRREL-CAGE INDUCTION MOTOR.
A.K.Guha and S.K.Sen.
J. Technol. (Calcutta), Vol. 4, No. 1, 15-35 (June, 1959).

A theoretical study of the effects of varying the airgap length on various aspects of induction-motor performance. Test results on a 5 h.p. 3 ph., squirrel-cage motor substantiate the theoretical results. A summary of textbook equations for recommended induction motor airgap lengths is included. H.Sterling

621.313.333.012.8

6597 THE PHYSICAL REALIZATION OF INDUCTION-MOTOR EQUIVALENT CIRCUITS.
N.N.Hancock and B.H.Karakaraddi.
Proc. Instn Elect. Engrs, Monogr. 406 U, publ. Oct., 1960, 8 pp.
To be republished in Part C.

Reviews the practicability of setting up physically, in the form of specialized networks, several of the equivalent circuits representing an unbalanced 2-phase induction motor. This motor is sufficiently general to include, as special cases, most induction machines with balanced secondary windings.

621.313.333.4

6598 FURTHER DEVELOPMENTS OF THE SELF-OSCILLATING INDUCTION MOTOR.
E.R.Laithwaite and G.F.Nix.
Proc. Instn Elect. Engrs, Paper 3273 U, publ. Oct., 1960 (Vol. 107A, 476-86).

The self-oscillating induction motor described in an earlier paper Abstr. 945 of 1956, in which two linear motors placed back-to-back are capable of producing a stable amplitude of oscillation of a moving runner without any switching device, cannot be made to operate in small sizes without careful design. Among the possible applications of such a system a traverse mechanism for textile package winders appears to be the most attractive. One of the principal requirements of traverse mechanisms is that the oscillating member should be as small as possible. The development of small self-oscillating motors of several types is described. In some of these the rotors contain iron, while in others they consist of slabs of conducting material. The system is found to operate under transient conditions at all times, and it has not been possible to establish a complete theoretical analysis. Nevertheless, an experimental approach has indicated some of the rules by which a small oscillating motor may be designed. Rotors of the order of only 30 g mass have been made to oscillate successfully, and speeds of over 500 traverse/min over a 14 in. length have been achieved with power input of the order of 100 W.

TRANSFORMERS

621.314.2

6599 DRY-TYPE TRANSFORMERS. A.E.Williams.
Elect. J., Vol. 164, No. 25, 1712-15 (June 17, 1960).

After outlining the advantages of dry-type transformers, the constructional features, insulation and performance of a typical buried unit with a ventilating pillar and a typical 300 kVA mining transformer are described. J.T.Hayden

621.314.2

6600 TRANSIENTS IN THE WINDINGS OF MULTILAYER PULSE TRANSFORMERS. I.M.Roife.
Elektrichestvo, 1960, No. 6, 71-5 (June). In Russian.

Examination of the transients in the windings of these transformers is of great importance in determining the form of the high voltage pulse and the conditions in which the interlayer insulation operates. The problems involved in the choice of equivalent circuit for a multilayer winding are considered together with a theoretical and experimental study of transients on the pulse front and peak and in the case of on-load breakdown.
Associated Electrical Industries (Manchester)

621.314.2

6601 IMPULSE VOLTAGES ON DISTRIBUTION APPARATUS RESULTING FROM H.V. SURGES ON DISTRIBUTION TRANSFORMERS. R.C.Holzer.
Energia elett., Vol. 37, No. 5, 426-44 (May, 1960). In Italian.

Experiments were conducted on a star/inter-star transformer subjected on the primary side to various forms of surge voltage with the secondary side neutral isolated or solidly earthed; the experiments were repeated for varying conditions of loading. The results show that substantial phase to earth voltages appear on the secondary side and a complete mathematical analysis is included to provide a theoretical explanation. It is concluded that the most serious overvoltages are those between the winding and earth and the worst condition appears when all three primary phases are simultaneously subject to a surge wave front. M.Rathbone

621.314.2

6602 TABLES FOR THE CALCULATION OF SMALL TRANSFORMERS WITH ALUMINIUM WINDINGS.
C.Weisel, W.Kleber and M.Sende.
Elektrie, Vol. 14, No. 6, 41-4 (June, 1960). In German.

621.314.2

6603 AN EXPERIMENTAL STUDY OF SURGES AND OSCILLATIONS IN WINDINGS OF CORE-TYPE TRANSFORMERS. E.L.White.
Proc. Instn Elect. Engrs, Paper 3286 S, publ. Oct., 1960 (Vol. 107A, 421-31).

Measurements on two experimental core-type transformers, one with two limbs and the other with three limbs, were used to test the validity of theories of transient oscillations in windings with particular reference to Coleman's theoretical treatment of multi-limb transformers. Wherever practicable, "equivalent single-limb" parameters were measured in accordance with this theory. Spectral distributions of oscillation frequencies and variations of mutual leakage inductance between winding elements with separation between elements were adopted as the main criteria in comparisons of experiment and theory. These comparisons showed the superiority of an exponential distribution of mutual inductance over other approximations assumed in theories. No critical oscillation frequency as predicted by Rüdenberg was reached or approached, but some support was found for assuming the velocity of travelling waves to be independent of frequency when calculating inter-section voltages. Measured responses in terms of spatial distribution, amplitude and waveform showed reasonable agreement with theory. The analytical treatment by Coleman of the transient behaviour of multi-limb transformers was verified by numerous tests.

621.314.2

6604 OSCILLATIONS IN A TRANSFORMER WINDING WITH PARTICULAR REFERENCE TO THE RESPONSE TO AN APPLIED SURGE. B.L.Coleman.
Proc. Instn Elect. Engrs, Paper 3287 S, publ. Oct., 1960 (Vol. 107A, 432-8).

Existing single-limb theory is revised by differentiating between magnetizing and leakage inductance effects. Analysis of m.m.f. and flux in multi-limb transformers enables the theory to be extended to a winding on two or three limbs. Solution of these cases is obtained by resolution into equivalent single-limb windings. Transient response to surges is discussed and expressions are evolved for current and potential distributions.

621.314.2 : 538.3

6605 THE MECHANICAL STRESSES DUE TO RADIAL ELECTROMAGNETIC FORCES IN A MULTILAYER COIL CARRYING A UNIFORM CURRENT, WITH RECTANGULAR CROSS-SECTION OF THE WINDING CONDUCTOR. A.A.Kuznetsov.
Zh. tekh. Fiz., Vol. 30, No. 5, 592-7 (May, 1960). In Russian.

Only the radial electromagnetic force is taken into account, since this is the cause of rupture stresses in the central windings. The thickness of the insulation between turns is neglected for simplicity, i.e. the filling factor is 1. The expressions obtained for the radial and tangential stresses σ are applied to Cockcroft's numerical example (Abstr. 3114 of 1928), giving $(\sigma_r)_{max} = 400$ kg/cm^2, $(\sigma_t)_{max} = 8100$ kg/cm^2, in agreement with the familiar fact that $(\sigma_t)_{max} > (\sigma_r)_{max}$. Cockcroft's mistake in neglecting σ in integration of $d/dr(r\sigma_r) - \sigma_t + rR = 0$, is pointed out. D.E.Brown

621.314.224

6606 SHORT-CIRCUIT FORCES BETWEEN CURRENT TRANSFORMERS. J.Gibler and J.Kleinschmidt.
Elektrie, Vol. 14, No. 5, 166-71 (May, 1960). In German.

Calculation and measuring methods are given for determination of the mechanical forces under short-circuit conditions between current transformers connected in parallel lines. Mathematical treatment for coaxial, circular and rectangular coils leads to exact and relatively simple equations. The forces were measured by means of a pendulum arrangement with one coil attached to the pendulum and the other firmly fixed. The swing of the pendulum when coils are excited gives a measure of the effective force. In the two numerical cases considered, for a surge of 4×10^5 AT, the forces measured between the two 10 kV transformers mounted coaxially at 190 mm apart were 573 and 1409 kg respectively. The influence of the secondary winding, the burden and the magnetic state of the core on the mutual forces between primaries are briefly described. The relationship of the force and the distance between conductors for various axial arrangements of current transformers is also discussed and illustrated in diagrams. W.J.Grek

POWER CONVERSION

621.314.6

6607 SOME CONSIDERATIONS IN THE APPLICATION OF POWER RECTIFIERS AND CONVERTORS.
J.P.McBreen.
Proc. Instn Elect. Engrs, Paper 3215U, publ. Feb., 1960 (Vol. 107A, 445-54, 454-60, Oct., 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 2027 of 1960.

621.314.63

6608 GERMANIUM RECTIFIERS FOR ELECTROPLATING AND ELECTROLYTIC PROCESSES. H.Völger.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 12, 285-91 (June 13, 1960). In German.

Reviews the application of Ge rectifiers and associated equipment. Main considerations in the selection of semiconductor rectifiers are discussed. Various cooling methods, circuit configurations and protective gear are examined. Use of an adjustable transformer with carbon-roller contacts, induction regulator, or self-saturating reactor is surveyed. The application of magnetic and transistor amplifiers for constant-current regulation is mentioned. 7 references. P.Szekely

621.314.63

6609 DESIGN OF COOLING FINS FOR SILICON POWER RECTIFIERS. J.H.Tuley.
Mullard tech. Commun., Vol. 5, 118-30 (June, 1960).

After a theoretical analysis, a practical design procedure is given for plane cooling fins for silicon power rectifiers, both for single rectifiers and for stacks. The effects of fin material and surface treatment are considered, as well as the achievement of a compromise between fin size and economy of material. The possible reduction of fin size with forced air cooling is calculated. In a stack designed on these principles the calculated and measured performances are shown to agree closely.

621.314.63

6610 FORWARD VOLTAGE DROP AND POWER LOSS IN SILICON RECTIFIERS. W.Luft.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 179-83 (1960) = Applic. and Industr., No. 49 (July, 1960).

The instantaneous forward voltage drop of silicon diodes of different sizes and processes is investigated over four magnitudes of current density. The temperature influence is determined. An equation relating the instantaneous forward voltage drop to current density and junction temperature is given. An expression of the average forward voltage drop and power loss as function of current density and conduction angle is developed.

621.314.65

6611 EFFECTS OF DISTORTED PRIMARY VOLTAGES ON MERCURY ARC RECTIFIERS. T.G.O'Meally.
J. Instn Engrs Australia, Vol. 32, No. 1-2, 19-23 (Jan.-Feb., 1960).

It is known that distortion of primary voltages by the presence of harmonics has adverse effects on the performance of an installation. The two main phenomena which can arise are unequal load distribution between the anodes under certain circumstances and the introduction of spurious harmonics into the output wave. Both these effects are analysed, with restriction to fifth harmonics, but the methods outlined easily lend themselves to extension to the less important higher harmonics. Results derived are applicable to grid-less rectifiers, as the analysis of grid-controlled systems has already been carried out.

POWER TRANSMISSION
OVERHEAD LINES . CABLES

621.315.1

6612 EFFECT OF CORONA ON VOLTAGE SURGES IN TRANSIENT CONDITIONS ON TRANSMISSION LINES. G.N.Aleksandrov.
Elektrichestvo, 1960, No. 5, 6-13 (May). In Russian.

The present tendency to lower the insulation level of long transmission lines requires careful examination of those factors which help in reducing voltage surges. One of these factors is corona. A method of evaluating the effect of corona on voltage surges during transient conditions is presented. Examples are given of the reduction in the voltage amplitude on 220, 500 and 600 kV lines under the influence of corona. 9 references.
Associated Electrical Industries (Manchester)

621.315.1

6613 ECONOMIC ASPECTS OF A.C. TRANSMISSION AT VOLTAGES ABOVE 380 kV IN WESTERN GERMANY.
Elektrizitätswirtschaft, Vol. 59, No. 10, 316-19 (May 20, 1960). In German.

A study of future conditions indicates that there is no justification for the use of a voltage higher than 380 kV. The main reason is that transmission distances are relatively short and will tend to become shorter. A.P.Wilmshurst

621.315.211

6614 E.H.V. POWER CABLES. C.C.Barnes.
Elect. Rev., Vol. 166, No. 25, 1149-57 (June 17, 1960).

After tracing the historical background, the author discusses some examples of e.h.v. cable installations throughout the world and describes how the design difficulties were overcome. H.V.D.C. transmission is briefly considered and future trends in cable research and development are discussed.
Central Electricity Generating Board Digest

621.315.221.7

6615 DESIGN AND OPERATION OF CORRUGATED COPPER SHEATHED CABLES. H.Himbert.
Elektrizitätswirtschaft, Vol. 59, No. 12, 386-90 (June, 1960). In German.

The principles of design and the installation and behaviour of corrugated copper sheathed cables and their accessories are discussed, including problems of earthing and of electrolytic action.
H.Norel

621.315.232

6616 THRUST-BORING EQUIPMENT FOR INSTALLING PIPES UNDER ROADS AND RAILWAY EMBANKMENTS. H.Hänni.
Tech. Mitt. P.T.T., Vol. 38, No. 5, 164-71 (1960). In German and French.

Describes equipment used for driving pipes and conduits beneath roads and railway embankments. Iron and steel tubes up to 6" diameter have been efficiently installed at rates dependent upon the terrain of 3 to 5 metres/hr. Manually operated and hydraulic-assisted equipment is available and power-driven equipment has been placed on the market for handling still larger diameter pipes. Experience has yet to be gained with the latter type. In principle the tubes are forced through the earth by a rack-and-pinion mechanism. Success depends upon the nature of the soil and absence of obstructions such as rock or other installations. Where the equipment can be successfully employed considerable economies can be effected. R.J.Jordan

621.315.28

6617 THE INFLUENCE ON A SHIP'S MAGNETIC COMPASS OF A SUBMARINE CABLE CARRYING DIRECT CURRENT. I.Herlitz and S.Helmersson.
Direct Curr., Vol. 4, No. 8, 220-5, 229 (March, 1960).

Details are given of the calculations but it is concluded that the effect is almost always negligible in practice. V.G.Welsby

INSULATORS
SUPPORTS . CONNECTIONS

(See also Insulating Materials)

621.315.62 : 621.316.934

PROTECTION OF HIGH-VOLTAGE INSULATORS FROM POWER-ARC DAMAGE. See Abstr. 5453

621.315.623.7

6618 THE EFFECT OF PREDISCHARGES ON THE FLASH-OVER BEHAVIOUR OF THE STANDARD ARRANGEMENTS OF PIN-TYPE INSULATORS IN AIR. W.Hermstein.
Elektrotech. Z.(E.T.Z.) A, Vol. 81, No. 12, 413-21 (June 6, 1960). In German.

The characteristics of discharges between cylindrical electrodes were studied when the gap was occupied by air or by an insulating cylinder. The effect on flashover voltage of d.c. - and impulse-voltages was compared with that of a.c. The discharge phenomena at the electrodes differed greatly as the voltage increased and depended on the electrode construction, gap size, the type of voltage and its polarity. The results have application to nearly all h.v. equipment using air insulation. I.D.L.Ball

621.315.624 : 621.317.333.8

6619 THE SURGE FLASHOVER VOLTAGES OF AIR-GAPS ASSOCIATED WITH INSULATORS AND BUSHINGS. G.W.Bowdler and R.C.Hughes.
Proc. Instn Elect. Engrs, Paper 3317 S, publ. Oct. 1960 (Vol. 107 A, 439-44).

The paper, which is based on E.R.A. Reports Ref. S/T92 and S/T105, summarizes the results of tests made with surge voltages of 1/50 microsec waveshape on a wide range of insulators and air-gaps over a period of 10 years. In determining 50% flashover voltages it was found that the range of voltages over which transition from no flashover to flashover on each of 10 applications of the surge occurred was somewhat variable but averaged about 15% for small and 7% for large insulators and gaps. The extent of this range, in conjunction with the finite number of surges (50-100) generally employed, could account for the variations obtained in the values, corrected to standard atmospheric conditions, of the 50% flashover voltage of a given insulator. In all the systems tested the electric field between the electrodes was highly non-uniform, and a roughly common relationship was found to exist between V, the average value of the positive and negative 50% flashover and the length of the corresponding flashover path. The time-lag curves obtained in tests at higher voltages on systems with small polarity differences approximated to exponential curves decaying with a time-constant of 2.9 microsec to a voltage V and passing through 1.5 V at 2 microsec.

621.315.668.1

6620 PROGRESS IN IMPREGNATING MATERIALS FOR WOODEN POSTS USED FOR AERIAL LINES.
Bull. Assoc. Suisse Elect., Vol. 51, No. 7, 369-76 (April 9, 1960). In French.

The report prepared for discussion at the 21st meeting of the U.C.S. at Lucerne in 1959 is expanded in this article to include more recent results from work by the commission of U.C.S. for the study of impregnation processes and subsequent treatment of wooden posts. The object was to find the most suitable treatment of line posts in Switzerland to give long service. It describes the use of copper sulphate and various proprietary salts, their methods of application and subsequent treatment of the pole bases compared with normal creosote-treated poles in field trials. Results over seven years are tabulated. It is concluded that copper sulphate-treated poles require retreatment every 8 to 10 years. One proprietary mixture is recommended since subsequent treatment appears not to be required in its case. 12 references. W.A.Walker

DISTRIBUTION . INSTALLATIONS

621.316.13

6621 DETERMINATION OF THE MOTOR LOAD IN 3-PHASE NETWORKS. W.Cremer.
Elektrizitätswirtschaft, Vol. 59, No. 12, 377-82 (June, 1960). In German.

Two methods are derived whereby the motor load in a 3-phase network, as well as other load characteristics, may be determined by relatively simple measurements of the reaction of the network to a rapid small voltage variation (for instance produced by tap-changing on a distribution transformer), or to a short asymmetry. H.Norel

SWITCHGEAR

621.316.5

6622 DEVELOPMENT TRENDS IN LOW-VOLTAGE SWITCHGEAR DESIGN. K.Ose.
Elektrizitätswirtschaft, Vol. 59, No. 12, 382-5 (June, 1960). In German.

Tendencies in modern low-voltage switchgear design are described, including reduction of size and of installation and maintenance costs, mobility and versatility, increased safety, transparent covers and suitability for mass production. H.Norel

621.316.5.066.6

6623 THE MECHANICAL DEFORMATION OF ELECTRICAL CONTACTS BY THE ARC AT BREAK.
A.Keil and C.L.Meyer.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 13, 309-11 (June 27, 1960).

In high-current contacts the surfaces develop a curvature, analagous to a well-known phenomenon in welding technique, due to melting and subsequent cooling of the central part of the contact faces. Some experimental results are given and discussed. P.M.Davidson

621.316.5.066.6

6624 WELDING DEFORMATION IN STATIONARY HIGH-CURRENT CONTACTS MADE OF ALLOYS. A.Wollenek.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 10, 370-3 (May 9, 1960). In German.

Recent experimental work on this subject is summarized, and results for various sintered alloys are given. See also following abstract. P.M.Davidson

621.316.5.066.6

6625 THE WELDING DEFORMATION OF REBOUNDING HIGH-CURRENT CONTACTS. A.Wollenek.
V.D.I.Z., Vol. 102, No. 22, 1053-60 (Aug. 1, 1960). In German.

Previous work on welding deformation (see preceding abstract) is extended to the case of rebounding contacts. P.M.Davidson

621.316.542.3

6626 ILLUMINATED PRESS-BUTTONS FOR INDICATION AND SWITCHING. J.F.Franzen and H.Vogel.
Siemens-Z., Vol. 34, No. 7, 427-30 (July, 1960). In German.

A series of illuminated buttons including spring-loaded and locking-type pushbuttons, rotary buttons, rotary pushbuttons, and magnetic buttons with built-in indication lamp are described. A variety of combinations, small mounting dimensions, and clear button-identification permit the construction of functional control panels of any type and size. The structural design and features of the different models are described and typical applications outlined.

REGULATION

621.316.71

6627 SUPERVISION AND CONTROL OF THE BLAST FURNACES AT ROURKELA (INDIA) WITH THE AID OF TELEPERM EQUIPMENT. W.Liesegang.
Siemens-Z., Vol. 34, No. 7, 405-10 (July, 1960). In German.

The ironwprks of the Hindustan Steel Ltd. at Rourkela are equipped with three blast furnaces, each of which has a daily output of 1000 tons of pig iron. By June, 1960, two of these furnaces will have been blown in by means of their associated six hot-blast stoves. After giving a survey of the economic basis of the raw-material supplies, the supervisory and control equipment based on the Teleperm system is described.

621.316.71

6628 OPTIMUM SETTING OF WATER-TURBINE GOVERNORS. H.Schiott.
Trans Soc. Instrum. Technol., Vol. 12, No. 1, 22-32 (March, 1960).

The problem of obtaining optimum performance for water-turbine speed governors was investigated with the aid of an analogue computer. The results are presented in the form of graphs from which the desired system response can easily be chosen and the corresponding governor settings be read. It is further proved that in some cases the restriction imposed by the water inertia on the regulation time can be appreciably reduced by the introduction of a "D" (derivative) term in the conventional "P-I" (proportional-integral) regulator. Practical tests carried out on existing water turbines have substantially confirmed the results.

621.316.718.5 : 621.314.65

6629 GRID CONTROL OF MERCURY-ARC RECTIFIERS BY MEANS OF HALF-WAVE MAGNETIC AMPLIFIERS.
S.S.Roizen.
Elektrichestvo, 1960, No. 5, 39-45 (May). In Russian.

Modern electric drives with a controlled mercury-arc rectifier for speed control have the drawback that the grid control equipment introduces a considerable lag and is therefore not always satisfactory. Grid-control systems containing half-wave magnetic amplifiers are studied. Such systems are rapid in operation and extremely simple and the time lag is commensurate with that of the mercury-arc rectifier. A brief description is given of an automatic drive in which the rectifier is controlled by a half-wave magnetic amplifier. Associated Electrical Industries (Manchester)

621.316.721

6630 A SIMPLE SUPPLY-COMPENSATED CONSTANT CURRENT SOURCE. P.Pargas.
Electronic Engng, Vol. 32, 490-2 (Aug., 1960).

A simple circuit is described to provide a current of very high stability for the measuring slidewire of a self-balancing potentiometer. The overall long-term stability obtained over a period of 10^3 hr is better than 0.1%, in spite of mains fluctuations and temperature variations.

621.316.726

6631 CONTROLLING ALTERNATOR FREQUENCY. H.Etches.
Electronic Industr., Vol. 19, No. 3, 104-9 (March, 1960).

Describes with the aid of block diagrams a fine speed and load sharing control system for airborne 400 c/s alternators. The frequency error detector makes use of two small synchronous motors, one of which is driven by the amplified frequency reference signal and the other from the alternator output. These motors are connected to form an electrical differential so that the output shaft

velocity is proportional to the difference between the two input frequencies. A potentiometer is connected to the output shaft and an error signal is produced which is a rate-of-change of output-voltage proportional to the difference in frequency. The load sharing, failure protection and servo arrangements are mentioned briefly.

J.T.Hayden

PROTECTION

621.316.925

6632 OVERVOLTAGES ASSOCIATED WITH THE ELIMINATION OF SHORT CIRCUITS IN NETWORKS WHOSE NEUTRAL IS EARTHED THROUGH A REACTANCE: P.Le Verre.
Bull. Soc. Franc. Elect. (Ser. 8), Vol. 1, No. 1, 200-18 (April, 1960). In French.

A comprehensive study of overvoltages in reactance-earthed networks. Laboratory tests on the mechanics of overvoltage are described, together with a method of calculating the magnitude of these when various methods of circuit-breaking are employed. Details of further experiments on full-scale networks are given and suggestions for limiting the level of overvoltages are made.

D.R.Way

621.316.925.45

6633 INVESTIGATION OF A THREE-PHASE DIRECTIONAL RESISTANCE RELAY. S.B.Losev and A.B.Chernin.
Elektrichestvo, 1960, No. 6, 29-38 (June). In Russian.

A generalized method is given for the study of such a relay, and an analysis is made of the behaviour of the relay in different cases of short-circuits and open-conductor conditions. It is shown that the method is convenient for the evaluation of the selectivity and sensitivity of the relay of short-circuits and interruptions.

Associated Electrical Industries (Manchester)

621.316.93 : 621.317.7

6634 A SIMPLE METHOD FOR METER PROTECTION IN HIGH VOLTAGE WORK. A.Sandor.
Sylvania Technol., Vol. 13, No. 2, 70-2 (April, 1960).

A simple way is shown for protecting meters of the D'Arsonval type against high-voltage surges in cathode-ray tube work. The meter is shunted by a commercial minature glow lamp that fires instantaneously when the maximum range of the instrument is exceeded. Two different arrangements of series and parallel–series resistors leading to the proper firing voltage are discussed and the required values are calculated. The shift in currents though the meter and the lamp branch after the discharge begins is quantitatively derived. The solution with the firing resistance is series with the glow lamp is shown to afford more reliable protection of the firing characteristic of the lamp.

621.316.973

6635 THE INFLUENCE OF CAPACITANCE ON SAFETY IN LOW-VOLTAGE ELECTRICAL SYSTEMS. G.V.Mindeli.
Elektrichestvo, 1960, No. 2, 82-4 (Feb.). In Russian.

In low-voltage insulated systems, and particularly in mines, it is important to keep the current which can flow through a man's body, if he should come into contact with the line, to the absolute minimum. It is frequently considered that this current is entirely dependent on the resistance of the system to ground and the capacitance of the system to ground is ignored. It is shown that the capacitance plays an important part in influencing the value of this current. In systems of low insulation-resistance, capacitance can be used to keep the current which could flow through a man's body to a safe level. A number of graphs relating resistance, capacitance and available current to different values of resistance of the human body are given. In the case of complicated networks automatic control of the compensating capacitance is feasible.

J.S.Wilson

TRACTION . DRIVES

621.332.23.104.6

6636 DISTURBANCES IN LIGHT-CURRENT LINES PRODUCED BY ELECTRIC TRACTION LINES. E.L.Castiglioni.
Rev. Electrotec., Vol. 46, No. 3, 81-95 (March, 1960). In Spanish.

A thorough theoretical investigation of these disturbances, dealing in particular with single-phase 50 c/s systems at 25 kV. Electrostatic and electromagnetic effects are taken into consideration. Groups of simultaneous linear equations are given for the relations between potentials and potential differences respectively on the one hand and electric charges on the other hand, for the case of "n" conductors. These equations are then applied for finding the potential on a light-current line adjoining a traction line. Two separate cases are then dealt with, one without an earth return cable, the other with such a cable. In dealing with electromagnetic effects the following cases are dealt with: short-circuit in the catenary, longitudinal e.m.f.'s. induced on aerial telecommunication lines and those induced on telecommunication cables for great distances. The investigations are based on theoretical and experimental investigations made in France.

R.Neumann

621.332.6

6637 REMOTE-CONTROL OPERATION ON THE LUDVIKA–OXELÖSUND LINE (SWEDEN). G.Lentz.
Elekt. Bahnen, Vol. 31, No. 2, 41-5 (Feb., 1960). In German.

A detailed illustrated description of this remote control interlocking installation. The line is about 300 km long, has 36 intermediate stations and serves for heavy and extra-heavy ore trains, passenger trains and motor-coaches. The whole line is subdivided into six channels, all served from the Skogstorp central station. Signals for operating the disconnectors and circuit-breakers and for controlling the positions of the points are given by a double impulse using a polarized inductive impulse system. Position indicators show the operator the state of disconnectors, circuit-breakers and points on a large mimic diagram in the central station. After completion, 280 points, 385 signals, 16 loading and unloading stations and 3 turning bridges will be centrally controlled while it will also be possible to operate sections of the plant locally.

R.Neumann

621.335.2

6638 RECENT RESEARCH ON AIR INTAKE LOUVRES AND AIR FILTERS OF ELECTRIC LOCOMOTIVES.
K.Bauern.eister.
Elect. Traction Rlys (Internat. Rly Congr. Assoc.), Vol. 11, No. 3, 105-31 (March, 1960).

Outlines the cooling requirements of modern locomotives and the theory of louvre design. Louvres with several kinds of horizontal slats are described, and their inadequacy explained. A newly developed multi-nozzle-type air-intake louvre with vertical slats removes rain, snow and coarse dust efficiently, and gives a uniform air flow independent of speed or direction of travel. Fine dust particles are retained by air filters, several types of which are described.

E.F.Hansford

621.34

6639 ROLLING MILL AUXILIARY DRIVES.
F.M.W.Rhodes.
Elect. J., Vol. 165, No. 1, 24-8 (July 1, 1960).

The effect of steelworks conditions on lubrication, ventilation and location of driving motors and m.g. sets is discussed and an account given of the applications of the Ward Leonard and contactor control systems. A typical control scheme for both systems is illustrated and attention is drawn to design problems.

M.Rathbone

621.34

6640 HUNTING IN ELECTRIC-SHAFT SYSTEMS AND MEASURES FOR ITS SUPPRESSION. F.Ungruh.
Siemens-Z., Vol. 34, No. 7, 437-44 (July, 1960). In German.

If two drive groups are coupled by means of an electric shaft they form a spring-mass system which may lead to torsional vibrations. To evaluate the associated phenomena, a distinction must be made between self-excited hunting and separately excited hunting. Self-excited hunting can occur if the damping of the electric shaft or of the drive motors becomes negative, which, under certain operating conditions, is quite feasible. After a description of the physical relationships an illustration is given of the various electrical and mechanical measures for suppressing undesirable hunting, and the range of applications is defined.

INSULATING MATERIALS
DIELECTRICS

621.315.611 : 539.2 : 537.2

6641 ON THE KINETICS OF PRE-BREAKDOWN PROCESSES IN SOLID INSULATION. K.W.Böer and U.Kümmel.
Elektrie, Vol. 14, No. 5, 148-52, with one page of photographs on inside back cover (May, 1960). In German.

Single crystals of cadmium sulphide were chosen for investigation of the processes of thermal and field-breakdown. The former process was followed by means of an electro-thermo-optical effect which enables the internal temperature and so the current distribution to be seen. A similar effect was used to show the internal potential distribution. Some previously unobserved effects were noticed. One point of interest was the similarity of some of these effects with the processes in gas discharges. 19 references, many to earlier work by the authors on CdS. I.D.L.Ball

621.315.612 : 621.317.335.3

DETERMINATION OF THE DIELECTRIC PROPERTIES OF LOW-LOSS CERAMICS AT Q-BAND FREQUENCIES. See Abstr. 5495

621.315.614.64

6642 A NEW EXPLANATION OF GAS EVOLUTION IN ELECTRICALLY STRESSED OIL-IMPREGNATED PAPER INSULATION. Z.Krasucki, H.F.Church and C.G.Garton.
J. Electrochem. Soc., Vol. 107, No. 7, 598-602 (July, 1960).

In void-free oil-impregnated paper, gas evolution starts at a critical stress which is markedly dependent on the degree of dryness of the paper. The gas first formed arises from decomposition of water in the cellulose, the nature of the impregnant having little effect. Subsequent more rapid gassing resulting from decomposition of the oil is a secondary process depending on ionization within gas bubbles previously formed. Study of the fundamental primary process suggests that water absorbed by the cellulose is ionized by electron bombardment in regions of high stress and is then decomposed electrochemically.

621.315.615.2

6643 PASSIVATED TRANSFORMER OIL. F.Highes and L.G.Wood.
Elect. Rev., Vol. 167, No. 5, 181-4 (July 29, 1960).

Under service conditions, transformer oil containing metal deactivators has been shown to suppress effectively dissolution of metals in oil and prevent metal-catalyzed oil deterioration. Data are given on the performance of a passivated transformer oil used in tests carried out under arduous conditions, on thirty distribution transformers, with ratings from 200 to 625 kVA, where previously B.S. 148 transformer oil developed a high acid and copper content in a short time. A passivated transformer oil has been found after five years to be free of copper and low in acidity.
Central Electricity Generating Board Digest

621.315.616

6644 ASSESSMENT OF THERMOSETTING PLASTICS BY A DIELECTRIC AND PRESSURE TECHNOLOGICAL METHOD. F.Lojda.
Elektrotech. Obzor, Vol. 49, No. 4, 208-11 (1960). In Slovak.

For the assessment of quality of cresol-formeldehyde thermosetting plastics, samples are taken, which are dried at 150°C for varying times. The loss angle of the samples is measured. As, for purposes of production, the plastic properties of the materials are important, in parallel with the previous measurements, samples are pressed between the electrodes at a pressure of 50 kg/cm^2 and the strain as a function of time is determined. The most suitable plastic for a desired purpose is found in this way. N.Klein

621.315.616.9

6645 PROPERTIES OF INSULATION SUBJECTED TO RADIOACTIVE RADIATION. K.A.Vodop'yanov, B.I.Vorozhtsov, G.I.Potakhova and N.I.Olshanskay.
Elektrichestvo, 1960, No. 5, 60-6 (May). In Russian.

Contains experimental data from a study of the action of gamma radiation on the electrical and physical characteristics of high-polymer dielectrics, silicone and phenol-formaldehyde plastics. Irradiation was by means of a 15 MeV betatron with a dosage capacity of 300-1200 r/min. The specimens were irradiated at different temperatures and in tropical humidity conditions. It is shown that the radiation-resistance of insulating materials depends not only on the properties of the material and its structure, but also on the ambient conditions during irradiation and examination.
Associated Electrical Industries (Manchester)

621.315.617

6646 COMPATIBILITY OF MAGNET WIRE INSULATIONS AND EPOXY ENCAPSULATING RESINS. H.Lee.
A.S.T.M. Bull., No. 247, 69-73 (July, 1960).

The compatibility of amine and acid-catalyzed epoxy resin encapsulating systems with ten commercial magnet wires is described. Test methods discussed include field tests on a.c. motors, chemical resistance tests, motorette tests, and twisted-pair tests. Results of three types of twisted-pair tests are described in detail: some wires are attacked, some are markedly reinforced by certain resin systems. It is concluded that each resin system and wire should be specifically checked prior to use.

MEASURING METHODS
ELECTRICAL TESTING

621.317.2 : 621.315.174

6647 A MOBILE VIBRATION LABORATORY UNIT FOR MONITORING DYNAMIC CHARACTERISTICS OF OVERHEAD TRANSMISSION LINES (DYNALAB).
J.R.Ruhlman, J.C.Poffenberger and S.Grosshandler.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 624-39 (1959) - Pwr Apparatus Syst., No. 43 (Aug., 1959).

A description is given of a mobile laboratory developed for measuring the vibrations of overhead transmission lines. Records are made of meteorological data such as wind velocity and direction, barometric pressure, atmospheric temperature and humidity, of strain in the conductors (by resistance gauges), of the curve of the conductors (by accelerometers), and of loop length and frequency (again by strain gauges). Two versions of the equipment are described. In the first, the gauge circuits are connected with the amplifiers and recorders by wires, while, in the second, radio linkages employing frequency modulated signals are used. The incoming signals in both cases are compared with certain predetermined signals levels and the recording equipment is energized only when these levels are exceeded. The circuits are arranged to record according to two predetermined programmes, but these can be modified easily. A.C.Whiffin

621.317.333

6648 INSULATION RESISTANCE MEASUREMENTS WITH AN ELECTRONIC ELECTROMETER UP TO 10^{16} OHMS.
B.Bortoletto.
I.R.E.Trans Instrumentation, Vol. I-9, No. 1, 28-31 (June, 1960).

An electronic electrometer designed and developed for the measurement of very high insulation resistances in parallel with high capacitances, as in the case of long lengths of submarine polyethylene-insulated cables, is described. The instrument, being very sensitive, also allows the measurement of the insulation resistance of joints between the cores. The measurement in this case is carried out on a length of core two feet long containing the joint; this length is placed in an insulated and screened trough full of water. Charging with an e.m.f. of 600 V the capacitor formed by the central conductor of the core and the water, the loss of charge as a function of time can be measured by means of the electrometer as a difference between the voltage of the e.m.f. and that of the capacitor. Using this instrument it has been possible to measure resistances as high as 10^{16} ohms. To measure the insulation resistance of long lengths of cables it is necessary to use two different batteries: one for charging the cable and the second one (having exactly the same voltage) for carrying out the measurement. Particulars of the construction of the electrometer are given, pointing out the necessary precautions to keep the battery voltage rigorously constant and to prevent condensation inside the instrument.

621.317.333 : 621.315.614 : 621.315.21

6649 THE IMPULSE STRENGTH OF FULLY-IMPREGNATED PAPER DIELECTRICS AS USED IN HIGH-VOLTAGE CABLES. B.Salvage and J.A.M.Gibbons.
Proc. Instn Elect. Engrs, Paper 3143 S, publ. Dec., 1959 (Vol. 107 A, 405-14, 415-20, Oct., 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 157 of 1960.

621.317.333.8 : 621.315.624

SURGE FLASHOVER VOLTAGES OF AIR-GAPS ASSOCIATED WITH INSULATORS AND BUSHINGS. See Abstr. 6619

621.317.34

6650 **UNITS FOR CURRENT NOISE.** P.L.Kirby and R.H.W.Burkett.
Electronic Engng, Vol. 32, 412-13 (July, 1960).

The relationship between current noise power, the voltage applied to a resistor and the frequency band of measurement is discussed. If the noise power spectrum is 1/f it is shown that a practical unit for the expression of noise is $\mu V/V$ in a decade. It is proposed that such a standard be adopted. The errors arising from the assumption of a 1/f frequency relationship are calculated for the practical cases of $E_N^2 \propto 1/f^{0.8}$ to $E_N^2 \propto 1/f^{1.1}$ and it is shown that such errors are not so great as to make the proposed unit impracticable.

621.317.34 : 621.372.412

6651 **MEASUREMENT OF BANDWIDTH OF MICROWAVE RESONATOR BY PHASE SHIFT OF SIGNAL MODULATION.** D.S.Lerner and H.A.Wheeler.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 343-5 (May, 1960).

Bandwidth is measured by transmission of a signal with sine-wave modulation through a microwave resonator under test. The modulation frequency is adjusted so that the envelope is delayed 45° with respect to the input, indicating that the two side-band frequencies are separated by the half-power bandwidth. The resonance ratio (Q) is then equal to the ratio of carrier frequency over twice the modulation frequency. This depends on observations of these frequencies and the modulation phase shift, but not on the amplitude. It is insensitive to detuning or incident frequency variation of the resonator or the signal. In a resonant cavity tested, an observed bandwidth of 30 kc/s at 700 Mc/s indicated that Q = 23 300.

621.317.34 : 621.374.3

6652 **MILLIMICROSECOND PULSE INSTRUMENTATION FOR MICROWAVES.** J.T.Tippett.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 32-4 (June, 1960).

A circuit utilizing a fast microwave diode switch as an ultra-fast rise time pulse generator, a dual output detector, and a travelling-wave oscilloscope are discussed for use with pulse-amplitude-modulated microwave computer components. Using this same equipment with system modifications, test equipment can be built for phase-pulse-modulated microwave circuits. The microwave diode switch consists of a special germanium diode mounted in waveguide. Both the diode and waveguide mount were designed for minimum transition time between the operating states of the circuit involved. The detector was designed for use with a 1N23-type diode and has dual coaxial cable outputs. A travelling-wave oscilloscope was used for display. This system, with the use of a travelling-wave amplifier, was used for displaying pulse power levels of 0.1 mW with easy visual observations on the oscilloscope. No limitations were seen which would prevent this system from being used with lower pulse power levels if a higher gain, low-noise travelling-wave amplifier is used.

621.317.341

6653 **MICROWAVE ATTENUATION MEASUREMENTS WITH ACCURACIES FROM 0.0001 TO 0.06 DECIBEL OVER A RANGE OF 0.01 TO 50 DECIBELS.** G.F.Engen and R.W.Beatty.
J. Res. Nat. Bur. Stand., Vol. 64C, No. 2, 139-45 (April-June, 1960).

The application of certain power-stabilization and measurement techniques to the problem of attenuation measurement has yielded a measurement system with a stability and resolution of the order of 0.0001 decibel. A practical application for this technique was recently provided in the calibration of a rotary vane type of variable microwave attenuator.

621.317.39 : 534.23

6654 **A TUNED CAPACITIVE DETECTOR FOR HIGH FREQUENCY VIBRATIONS.** P.G.Bordoni and M.Nuovo.
Acustica, Vol. 8, No. 6, 351-62 (1958).

A new apparatus for studying the longitudinal vibrations of plates in the megacycle range has been developed using an electrostatic drive and detector. The mechanical vibrations are converted to an a.c. signal by means of a d.c. polarizing voltage applied to the probe as is normally done for electrostatic microphones. The detection circuit is tuned on the vibration frequency; in this way a high sensitivity has been obtained. Detailed information is given on the circuitry and on upper frequency limits for the application of the apparatus in the measurement of the mechanical properties of plates. Experimental data are given on the longitudinal sound velocity spectra, on the damping of various plates and on their dependence on temperature.

621.317.39 : 621.317.733

6655 **A STRAIN MEASURING BRIDGE WITH A CARRIER FREQUENCY OF 50 kc/s.** C.Rohrbach.
Arch. tech. Messen, No. 292 (Ref. J 924-3), 101-4 (May, 1960).
In German.

The use of a centre-tapped coil instead of resistance radio arms is shown to give a bridge network for the measurement of dynamic strain which is more sensitive and less susceptible to the effects of lead capacitance. The basic circuit of such an improved bridge is given and the use and performance of compensation inductors to eliminate phase-shift and loss of sensitivity are described. With 600 Ω strain gauges and leads up to 400 metres in length recordings of dynamic strains with frequencies up to 15 kc/s may be obtained.

T.R.Foord

621.317.39

6656 **A DYNAMIC STRAIN CALIBRATOR.** M.Halio.
Electronic Industr., Vol. 18, No. 12, 104-9 (Dec., 1959).

Gives details of wire and foil resistance strain gauges and of bridge-type circuits commonly employed in using them. Only part of the paper is concerned with the calibrator which consists essentially of switching six resistors into one arm of the Wheatstone bridge in succession to give stepped increments of resistance. The calibration resistors are connected in series, the junction between each of them being connected with a switching circuit comprising a mercury relay, selected to minimize contact resistance and to decrease electrical noise. The relays are operated by the output of an electronic switching unit consisting of a series of multivibrators.

A.C.Whiffin

621.317.39 : 620.172.222

6657 **DEVELOPMENT OF HIGH-TEMPERATURE STRAIN GAUGES.** R.Bertodo.
Proc. Instn Mech. Engrs, Vol. 173, No. 23, 605-16 (1959).

A review of work carried out in order to develop a strain gauge capable of operating at temperatures up to 1000°C with an inherent accuracy of ±5%. A large number of resistance alloys were tested as unbonded long wires at room temperature and, from results obtained, a small number were selected for further investigation, in the form of gauges, at high temperatures. The effects of factors such as metallurgical changes, geometric shape and long-term exposure on the behaviour of the gauges were investigated. A number of bonding mediums, some commercially available, were examined with particular reference to creep under load, shear strength and resistance to erosion and thermal shock. Finally some preliminary tests in conjunction with the measurement of steady strains at elevated temperatures were undertaken. It is concluded that the gauge factor is a function of the lattice imperfections of the element wire and, as such, will be temperature-conscious only if the imperfections themselves are affected by temperature variations. In general, any factor affecting the resistivity will affect the sensitivity. The most significant result obtained during the work described is that the gauge factor may be predicted within ±5% at any given temperature, provided certain precautions are observed. Some typical failures under field conditions are discussed as also are the possibilities of operating for protracted periods under steady stress conditions. More stringent requirements for future applications suggest that the wire gauge will be unsuitable, in view of its low resistance in very small sizes, and a possible alternative is briefly outlined.

621.317.39 : 620.172.222

6658 **TEMPERATURE COMPENSATED STRAIN GAUGES.** R.L.Chandler and E.J.Dent.
Electronic Engng, Vol. 32, 414-21 (July, 1960).

Wire-resistance strain gauges suffer from the limitation that when the temperature varies or is not accurately known an unknown error may be introduced. Gauges have been developed which compensate for temperature change over wide ranges. These use thermo-couples to develop a voltage which compensates for the signal voltage resulting from temperature changes, leaving only the signal due to the applied stress.

621.317.39

6659 AUTOMATIC SURVEYING SYSTEM MEASURES RUNWAY ROUGHNESS. R.S.Brown.
Electronics, Vol. 33, No. 25, 54-6 (June 17, 1960).

This device is used to record profile variations on runways at intervals of 6 in. at a peak speed of 15 measurements/sec. It consists of a light-beam projector and a profile measuring instrument, the principle of operation being similar to that of the rod and transit surveying equipment. The projector, which replaces the transit, projects a highly collimated light-beam down the runway and establishes a stable reference from which measurements are made. The measuring instrument, which replaces the rod, is towed down the runway and senses the position of the light. Equipment mounted on the profile measuring device measures and records the distance between the runway surface and the light-beam centre line. The projector light source is a 100 W zirconium crater arc lamp whose image is focused on a 0.01 in. pinhole which becomes a virtual light source for the collimator. Because the image is larger than the pinhole, the focus of the collimator becomes independent of the random wandering of the crater within the lamp. Mounted directly in front of the pinhole is a slotted disk chopper which modulates the light at a frequency of 1080 c/s, thereby enabling it to be distinguished from ambient sunlight. The measuring device consists of two major sub-systems: the beam-sensing system and the measuring and recording system. H.A.Miller

621.317.39

6660 USE OF MOIRÉ-FRINGE TECHNIQUES FOR THE MEASUREMENT OF VELOCITY. G.Hodgson.
Instrum. Pract., Vol. 14, No. 6, 638-41 (June, 1960).

An account is given of a velocity gauge, consisting of a line and space grating system and its associated optical components and a frequency meter. The separate units are described and a full explanation of their operation is given. Other possible applications of the apparatus are discussed.

621.317.39

6661 ACOUSTIC INSTRUMENTATION FOR MEASUREMENTS IN THE MINUTEMAN MISSILE SILO.
D.N.Keast and G.W.Kamperman.
J. Audio Engng Soc., Vol. 8, No. 3, 180-4 (July, 1960).

An instrumentation system was developed to measure, record, and analyse various properties of the dynamic pressure field in the Minuteman launching silo. This system permits the simultaneous recording of up to 13 channels of data from microphones placed in the silo environment. These data may then be processed to obtain frequency spectra, time correlation functions, and space correlation functions. The data acquisition system has a frequency response from 0 to 10 kc/s, a wide dynamic range, and (to permit correlation analyses) a maximum channel-to-channel phase difference of 10°. Various system design problems are discussed. These include the choice of transducers to function in the high-temperature high-vibration environment of the silo, the equalization of phase shift between the data channels, and the phase matching of filters for space correlation. Representative samples of data obtained with the system are used for illustration.

621.317.39

6662 ELIMINATION OF CROSS-COUPLING ERRORS IN RATE GYRO DATA. P.Mosner.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 48-51 (June, 1960).

In the situation where three orthogonally mounted rate-gyros are simultaneously to measure the angular velocity components experienced by a body about its axes, a type of cross-coupling error that is sometimes serious can be eliminated by a proper combination of the output signals. This cross-coupling is due to the fact that when a gyro element experiences an angular rate about its input axis, the rotor spin axis precesses, and thus the gyro is also partially sensitive to an angular velocity component other than the one intended. The procedure for eliminating this type of error requires knowing the spring constant and signal generator sensitivity for each gyro and then solving the three gyro performance equations simultaneously for the three desired angular velocity components. An alternate method of nullifying these cross-coupling effects is by applying suitable signals proportional to the errors to torquers installed on the output shafts of the three rate gyros. Since the output voltages are then in fact proportional to the desired angular rates, this method lends itself readily to use in control systems as well as to the gathering of data in a flight test program.

621.317.39

6663 ANALYSIS OF AXIAL ACCELEROMETER CAPABILITY TO PROVIDE TRAJECTORY DATA ON BALLISTIC RE-ENTRY VEHICLES. L.E.Foster.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 52-5 (June, 1960).

Presents an analytical method of determining accelerometer instrumentation performance as an integral part of re-entry vehicle instrumentation, utilizing r.f. data transmission. The system analysis integrates the effects of several system parameters as they influence the adequacy of re-entry vehicle acceleration measurements. The results of this analysis give data accuracy and accompanying trajectory error under re-entry flight conditions. The conditions under which the accelerometer system were assumed to operate take into account the various environmental effects acting on the airborne instrumentation system and their influence on resultant accuracy. The various types of error (random, bias, point, full-scale, etc.) are isolated and summed in accordance with their respective probability distributions. An illustrative example is performed to determine the feasibility of using a single range accelerometer to obtain re-entry acceleration at ranges from 1600 to 5500 nautical miles, while maintaining design quality data. The criterion for trajectory reconstruction is taken as the ability to find altitude versus time by integrating acceleration to obtain velocity vector changes, to an accuracy of greater than 2000 feet of the true altitude. The net average error during the deceleration cycle is obtained by converting the normal sine wave type characteristics of this pulse into an equivalent square pulse. The advantage of this is that the normal deceleration pulse has an error proportional to amplitude, which varies with time, while the error in the square pulse is constant with time.

621.317.39

6664 ON A MICROWAVE REFRACTOMETER. R.Schlnemann and W.Steffen.
Hochfrequenz tech. u. ElektAkust., Vol. 67, No. 3, 78-83 (Nov., 1958). In German.

The need for a microwave refractometer as the instrument for measurement of refractive index of atmosphere, in connection with scatter propagation, is explained. A refractometer capable of measuring the refractive index of the atmosphere to an accuracy of a fraction of 1N-unit in described and various circuit diagrams given. The instrument consists of an evacuated stable reference cavity and a similar cavity filled with atmospheric air to be measured. The difference between the resonant frequencues of the cavities is then a measure of the refractive index. Some experimental results and means of improving the accuracy of the instrument are discussed. A.E.Karbowiak

621.317.39 : 551.5

6665 PROBLEMS ASSOCIATED WITH PRECISE DETERMINATION OF THE INDEX OF REFRACTION OF THE EARTH'S ATMOSPHERE. A.M.Bush.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 23-8 (June, 1960).

In the aerial electronic geodetic surveying programme being conducted by the U.S.Air Force, accuracies in electronic distance measurement of the order of 10 feet in 200 miles are desired. To obtain such accuracy, a knowledge of the speed of propagation along the signal path is essential. The speed of propagation can be determined from a knowledge of the index of refraction of the atmosphere. The index of refraction of the atmosphere is not constant, but varies within the range 1.000000 to 1.000400 as a function of position and time; it may thus be considered as a time-varying scalar field. As with many fields, adequate representation of the index of refraction as a function of time and position is not, as yet, possible. The approach taken is to assume that the field is horizontally stratified, that is, that space variation is restricted to the vertical direction, and to ignore time variation. This representation is then used over a limited area and for a limited time after measurements are made. This paper is a statement of the problems involved in obtaining the representation of the index of refraction, followed by a description of an ideal method of measurement, two approaches to this ideal, and the method now being used.

621.317.39 : 621.317.733

6666 PRECISION TEMPERATURE MEASUREMENT OUTSIDE THE LABORATORY
W.H.P.Leslie, J.J.Hunter and D.Robb.
Research, Vol. 13, No. 7, 250-6 (July, 1960).

Existing resistance-thermometer techniques of millidegree accuracy were originated by Callendar in the 1890's and have not substantially altered since that date. To meet the problem of

measuring with this accuracy in field tests, new robust thermometers and the use of transformer ratio-arm bridges are proposed. Three methods for the elimination of the effect of the long leads to the thermometers are suggested; two of these have not been possible with the bridge methods at present favoured in other laboratories. Limited tests show sufficient promise to merit investigation and to suggest that a reconsideration of the techniques used for resistance-thermometer bridges is due. The bridges described are suitable for strain gauge and differential transformer use.

621.317.44 : 537.56

6667 MAGNETIC PROBES OF HIGH FREQUENCY RESPONSE. S.E.Segre and J.E.Allen.

J. sci. Instrum., Vol. 37, No. 10, 369-71 (Oct., 1960).

Probes for the measurement of the magnetic field distribution in fast pulsed discharges were constructed. Frequency response was measured and agreed well with that calculated from an equivalent circuit. The probes described have an attenuation flat (to within 1%) up to 20 Mc/s. A criterion is given which states the optimum value for the impedance of the recording circuit.

621.317.44

6668 A METHOD OF CONTROL MAGNETIC FIELD INTENSITY BY MEANS OF A CATHODE-RAY TUBE. H.Ezoe.

Sci. Pap. Inst. Phys. Chem. Res. (Tokyo), Vol. 53, No. 1512-23, 115-19 (Sept., 1959).

A new method to measure or control the magnetic field intensity by means of a cathode-ray tube is proposed. The principle is based on the simple fact that the magnetic field intensity is defined uniquely in relation to the electric field intensity if they are impressed on a cathode-ray beam perpendicularly with one another so as to keep the beam in a definite path. The idea may be applied, for example, to the scanning or the mass marking device of a mass spectrometer. Preliminary experimental work and its results are presented.

INSTRUMENTS
MEASURING APPARATUS

621.317.714 : 621.374.32

6669 AN AUTOMATIC DIGITAL RECORDER FOR IMPELLER-TYPE CURRENT-METERS. I-II. W.H.P.Leslie.

Instrum. Pract., Vol. 14, No. 8, 881-2 (Aug.); No. 9, 980-2 (Sept., 1960).

A new method of recording the speed of current-meters is described. An automatic control unit switches the counters on for a pre-selected period and number of timing cycles. After each period the counters are illuminated, photographed, and reset, and the next run commences. The timing period can be varied in steps between 5 and 1000 sec within an error of +0 −3 ms and ±0.001%. A special unit was designed for the calibration of current meters in a ship tank.

621.317.715

6670 THE ERRORS IN GALVANOMETERS APPLIED AS INTEGRATORS. L.A.Biber.

Elektrichestvo, 1960, No. 2, 77-81 (March). In Russian.

When the output of a system consists of a current or a voltage proportional to the derivative of the input, heavily damped moving-coil galvanometers are often used for integration and recording, and their behaviour and errors are analysed. The amplitude and phase errors for input pulses of various shapes are defined and calculated from the differential equation, supposing that the current through the coil is proportional to the derivative of the input. From the resulting curves these errors can be evaluated, taking into account pulse and galvanometer characteristics. The change of pulse shape has little effect on the amplitude error, but greatly influences the phase error. The amplitude error is a maximum when the shape of the pulse is nearly sinusoidal. V.Bradić

621.317.72

6671 THERMAL VOLTAGE CONVERTERS FOR ACCURATE VOLTAGE MEASUREMENTS TO 30 MEGACYCLES PER SECOND. F.L.Hermach and E.S.Williams.

Trans. Amer. Inst. Elect. Engrs I, Vol. 79, 200-6 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Thermal voltage convertors, each consisting of a resistor in series with a thermoelement in a coaxial line, have been developed for measurements of r.m.s. voltages of 1 to 200 V at frequencies from 3 c/s to 30 c/s. An accuracy of 0.1% or better may be obtained by a.c.-d.c. transfer techniques up to at least 10 Mc/s and 0.2% at 30 Mc/s.

621.317.725

6672 AN A.C. TRANSISTOR MILLIVOLTMETER WITH A HIGH INPUT IMPEDANCE. R.R.Vierbout.

Electronic Engng, Vol. 32, 435-7 (July, 1960).

After a preliminary explanation of the operation of feedback systems a description is given of a transistor millivoltmeter with an input impedance of 1 to 6 MΩ, a frequency-range of 1 c/s to 200 kc/s a full-scale deflection in the most sensitive range of 10 mV with an accuracy of 2% of full scale.

621.317.733 : 621.317.39

6673 TRANSFORMER BRIDGES FOR USE WITH RESISTANCE STRAIN GAUGES AND SIMILAR TRANSDUCERS. L.N.Clarke.

J. sci. Instrum., Vol. 37, No. 10, 381-4 (Oct., 1960).

A method of balancing a.c. bridges having transformer ratio arms is described which is particularly suitable for use with resistance transducers such as strain gauges. The long-time stability and accuracy of reading can be readily made better than required for most static testing by the use of an auxiliary transformer. The bridge can be combined with a commercial potentiometric recorder to form a multi-channel self-balancing a.c. bridge which can provide different ranges on successive channels. The balancing system lends itself to the control of testing machines, especially for the production of a given time-pattern of load or strain. The use of other types of transducer is considered.

621.317.733 : 621.317.39

A STRAIN MEASURING BRIDGE WITH A CARRIER FREQUENCY OF 50 kc/s. See Abstr. 6655

621.317.733 : 621.317.39

PRECISION TEMPERATURE MEASUREMENT OUTSIDE THE LABORATORY. See Abstr. 6666

621.317.74

6674 RATIO TRACING RECEIVER FOR U.H.F. MEASURING SETUPS. M.Niedereder.

Siemens Rev., Vol. 28, No. 7, 211-15 (Aug., 1960).

English translation of the paper already abstracted as Abstr. 4096 of 1960.

621.317.741

6675 A SELF-TUNING INSERTION-LOSS MEASURING EQUIPMENT (10 kc/s-1.5 Mc/s). G.J.Crank and H.A.Hathaway.

Post Off. elect. Engrs' J., Vol. 52, Pt 4, 280-5 (Jan., 1960).

This equipment, which was developed primarily for use at cable factories in connection with submarine-cable submerged repeater systems, has a measuring sensitivity of ± 0.001 dB when measuring attenuations of less than 80 dB; attenuations of up to 140 dB may be measured with reduced accuracy.

621.317.755 : 621.374.33

6676 AN OSCILLOGRAM ANALYSER. APPLICATIONS IN RADIO SPECTROSCOPY. M.Buyle-Bodin and J.Rosset.

J. Phys. Radium, Vol. 20, Suppl. 4, 32 A - 36 A (April, 1959). In French.

Describes a gate circuit which permits the extraction and isolation of any arbitrarily selected fraction of a recurrent sweep on a c.r.t. for detailed examination. The circuit employs five transistors and the gating effect is produced by applying two voltages across the input circuit: (1) a reference voltage; and (2) a voltage proportional to the instantaneous horizontal sweep voltage. Across these two inputs is connected a pair of reversed diodes biased so as to provide a suitable gate width. The reference voltage can be fixed so as to select a fixed portion of the trace. Alternatively, it can be related to the slower horizontal sweep of a second c.r.t. for a slow detailed scan of the whole trace. The device has applications in the study of nuclear resonances. H.G.M.Spratt

621.317.785

6677 ELECTRICITY METERS. A REVIEW OF PROGRESS. G.F.Shotter.

Proc. Instn Elect. Engrs, Paper 3343, publ. Oct., 1960 (Vol. 107A, 401-4).

MAGNETIC DEVICES AND MATERIALS

621.318.12 : 681.142

6678 MAGNETIC CORE MEMORIES. H.Soubies-Camy.
Automatisme, Vol. 5, No. 6, 223-8 (June, 1960). In French.

An explanation of the operation of a 3-wire-per-core, coincident-current, ferrite-core store and a discussion of the means of reducing spurious signals. An address decoder, also employing magnetic cores, is described. G.H.Stearman

621.318.13

6679 MAGNETIZATION REVERSAL IN THIN MAGNETIC FILMS WITHIN ONE NANOSECOND. W.Dietrich and W.E.Proebster.
Elektron. Rdsch., Vol. 14, No. 2, 47-9 (Feb., 1960). In German.

A new pulse measuring arrangement is discussed by which the rapid magnetization reversal in thin Permalloy strips (10^{-5} cm) can be demonstrated with a delay of 0.35 nsec. The measurements show reversing times of about 1 nsec. Curves of the reciprocal switching time as a function of the reversing magnetic field-strength show a rise of about 10^8 $(Oe.s)^{-1}$, which is nearly 100 times the value for solid material. The coherent reversal of magnetization as well as oscillation round the final state was shown from measurements of the flux component perpendicular to the direction of the reversing magnetic field. E.Maanders

621.318.381 : 538.1

6680 HIGH PERFORMANCE LABORATORY ELECTRO-MAGNET. L.Nowicki.
Acta phys. Polon., Vol. 18, No. 5, 531-4 (1959).

Describes briefly the construction and performance of a water-cooled electromagnet with adjustable gap, suitable for radio-spectroscopy. The magnet produces a 6 kOe field in a 4 cm gap between the 10 cm diameter poles. D.J.Truslove

621.318.381 : 538.1

6681 PRODUCTION OF A PULSED MAGNETIC FIELD USING AN ELECTROLYTIC CAPACITOR BANK. D.G.Bate and R.F.Saxe.
J. sci. Instrum., Vol. 37, No. 10, 378-81 (Oct., 1960).

An economical system for obtaining magnetic fields of the order of 10^4 G lasting for times of the order of milliseconds is described. A switch is operated by a falling mercury column and performs two switching operations separated by an adjustable, repeatable delay of a few milliseconds. Currents of the order of 10^4 A flow through the switch during operation. The source of stored energy is a capacitor bank of large capacitance and low voltage, and this is discharged through a solenoid by means of the switch.

INDUCTORS . REACTORS RELAYS

621.318.42

6682 SOME METHODS OF IMPROVING CHARACTERISTICS OF REACTORS WITH DIRECT CURRENT MAGNETISATION. I.S.Pinchuk and F.A.Zŷkin.
Elektrichestvo, 1960, No. 1, 78-80 (Jan.). In Russian.

Excitation characteristics of saturable reactors used for speed control of an induction motor are briefly discussed, particularly from the point of view of obtaining optimum output at the maximum speed of the motor. Optimum conditions are shown to be dependent not only on the core characteristics, but also on core and coil arrangements. Two methods of improving the excitation characteristics are suggested relative to the two-core type of reactor: (1) greater separation between the cores enclosed by the control winding; (2) using distributed-load windings partially or completely contained within the control winding. W.J.Grek

621.318.5.066.6

6683 THE DESIGN AND TESTING OF SEMI-PERMANENT METALLIC CONTACTS FOR USE AT LOW VOLTAGES. A.Fairweather and E.J.Frost.
Post. Off. elect. Engrs' J., Vol. 53, Pt 1, 26-33 (April, 1960).

The importance of surface contamination and the effects of different environments on various types of contact are discussed. Methods of contact testing including the use of artificial atmospheres to produce accelerated deterioration are also described.

621.318.562

6684 AN ANALYSIS OF A POLARIZED ELECTROMAGNETIC DRIVE SYSTEM AND OF VIBRATOR DRIVE SYSTEMS. R.S.Nunn.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 346-52 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Conventional electromagnetic contact-drive systems suffer from the disadvantage that resonant oscillation cannot be obtained, and this is shown in the analysis included. A scheme which overcomes this defect by the use of a permanent magnet and a tuned drive circuit is described. The drive power efficiency is shown to be greatly increased or alternatively for a given power input greater amplitudes of oscillation are obtained.

621.318.562.066.6

6685 MAGNETIC CIRCUIT OF HERMETICALLY CLOSED CONTACTS IN A PROTECTING GAS ATMOSPHERE. H.Rensch.
S.E.L. Nachr., Vol. 8, No. 1, 24-8 (1960). In German.

A new type of electrical contact has been developed in the Bell Telephone Laboratories under the name of the Reed contact, known in Germany as the Herkon (hermetisch abgeschlossener Kontakt). In the present work the magnetic circuit of this device is studied both theoretically and experimentally. P.M.Davidson

ELECTROSTATICS . CAPACITORS

621.319.3 : 537.2

6686 USEFUL LENGTH OF THE INSULATING COLUMN IN A SELF-EXCITING ELECTROSTATIC GENERATOR. K.S.Subudhi.
J. sci. Res. Banaras Hindu Univ., Vol. 9(2), 63-5 (1959-60: publ. June, 1959).

Experiments are described which show that the only useful part of the insulating column is that part above the earthed corona blade. E.G.Knowles

LAMPS . ILLUMINATION

621.32

6687 USE OF COMPUTERS IN DESIGN AND ANALYSIS OF LUMINAIRES. B.F.Jones.
Illum. Engng, Vol. 55, No. 7, 386-94 (July, 1960).

A method is outlined whereby, using an analogue representation, the performance of luminaires whose light-controlling surfaces are diffuse or semi-diffuse can be calculated, and useful information obtained on luminaires with mixed types of light-controlling media. Examples of computer calculations are included, and general ranges of accuracy are indicated.

621.32 : 621.383.2

PHOSPHORS FOR ELECTROLUMINESCENT LAMPS.
See Abstr. 6283

621.326.7 : 778.23

6688 A SIMPLE ELECTRONIC METHOD FOR AUTOMATICALLY POSITIONING LAMPS IN OPTICAL SYSTEMS. C.S.Fitzgerald.
I.R.E. Trans Industr. Electronics, Vol. IE-7, No. 1, 2-5 (March, 1960).

A lamp is inserted into an optical system consisting of a reflector, an aperture, a lens, and a screen. In general, the lamp filament is not located at the exact spatial position which would provide optimum intensity and uniformity on the screen. The lamp is translated along an axis of a Cartesian coordinate system, first past the point at which a maximum screen illumination is observed, then back to that point where the lamp movement is stopped. The above procedure is repeated sequentially along the second and third coordinate axes. The third maximum point corresponds to the optimum position for that lamp.

628.972 : 621.311.4

6689 LIGHTING OF INDOOR SUB-STATIONS FOR VOLTAGES OVER 60 kV. G.Baucik and E.Unterberger.
Elektrotech. Z. (E.T.E.) B, Vol. 12, No. 11, 266-9 (May 30, 1960). In German.

Indirect lighting has many advantages for sub-stations with high-voltage equipment, among them the high ratio of vertical to horizontal surface illumination. The use of tungsten lamps is advocated and it is shown that such an installation is cheaper than one with fluorescent lamps, at any rate for the first 18 years. A special type of fitting designed for easy maintenance is described. There is a brief account of a fluorescent system installed where conditions were especially suitable. J.W.T.Walsh

628.972

6690 RECOMMENDED PRACTICE FOR OFFICE LIGHTING. Illum. Engng, Vol. 55, No. 6, 313-44 (June, 1960).

ELECTROCHEMISTRY

621.352.3

6691 STUDY OF THE RECUPERATION REACTION IN THE LECLANCHE DRY CELL.
M.P.Korver, R.S.Johnson and N.C.Cahoon.
J. Electrochem. Soc., Vol. 107, No. 7, 587-91 (July, 1960).

The cathodic reaction in the Leclanche dry cell has been described previously as consisting of two steps. The first of these steps is the electrochemical reduction Mn^{IV} to Mn^{II}. The second step is the chemical reaction of Mn^{II} produced in the first step with unreacted Mn^{IV} to form an insoluble Mn^{III} compound. Two chemical reactions can occur producing MnOOH and $ZnO \cdot Mn_2O_3$, manganite and hetaerolite, respectively. The latter reactions, termed recuperation reactions, have been subjected to analysis and rate studies to determine the effects of factors such as pH, concentration, and temperature. These reactions are found to be slow enough to limit dry cell operation under certain conditions. The more active depolarizers, such as electrolytic MnO_2, show more rapid recuperation reaction than the natural MnO_2 ore. The basic concepts of heterogeneous chemical kinetics have been applied to this problem, and a simple mathematical equation was found which was applicable to all the data. These findings, correlated with previous results, support the cathode reaction mechanism theory previously presented.

621.355.1

6692 THE LATEST POSITION IN BATTERY TECHNIQUES. H.J.Stiger.
Schweiz. tech. Z. (S.T.Z.), Vol. 57, No. 11, 201-8 (March 17, 1960). In German.

A short survey of the development of electrochemical systems as batteries is followed by an account of the construction, properties and fields of application of lead, iron-nickel and silver-zinc batteries, and their more recent developments, such as the hollow-rod plates in lead batteries, sintered plates and sealed batteries. The work in progress on fuel cells is discussed and different practical cells are compared. There is no battery which is the best for all applications, each system has its own advantages or disadvantages. The lead battery in its different forms still remains the most universally applied. W.A.Walker

621.357 : 620.91

POWER NEEDS AND THE SITING OF ELECTROCHEMICAL PLANTS NEAR POWER SOURCES. See Abstr. 6547

621.357.1

6693 ELECTRICITY IN THE MANUFACTURE OF HYDROGEN PEROXIDE. B.E.A.Vigers and R.O.Fletcher.
Proc. Instn Elect. Engrs, Paper 3198 U, publ. Feb., 1960 (Vol. 107 A, 463-73, 473-5, Oct., 1960).

Republication, with discussion of the paper already abstracted as Abstr. 768 of 1960.

621.357.3

6694 PLATINUM AND PLATINUM-PLATED METALS AS CORROSION-RESISTANT ANODE MATERIALS.
G.Wranglén.
Tekn. T., Vol. 90, No. 20, 551-5 (May 13, 1960). In Swedish.

The low solubility of Pt makes it very suitable as an anode material in electrolysis, the main drawback being its high cost. Pt is now used as an anode in the electrolytic preparation of persulphates and perchlorates and also to a limited extent for cathodic corrosion protection. Pt inhibits oxygen liberation leading to good current exchange. Pt-plated metals as anode materials have recently been investigated. Cu and Ag required too thick Pt plating, the best metals being those which, on anode loading, form an insoluble non-conducting oxide layer, a barrier layer, which blocks the pores in the Pt film. The Pt is plated to a thickness of 1-6 μ. W did not give complete blocking effect, the most satisfactory results being obtained with Ti and Ta, which gave smooth and good adhesive films. Their use is described in greater detail. G.N.J.Beck

621.357.7

6695 THE POSSIBLE APPLICATIONS OF ULTRASONICS IN ELECTROPLATING. J.M.Odekerken.
Brit. Commun. and Electronics, Vol. 7, No. 5, 346-7 (May, 1960).

The influence of ultrasonics on the electrolyte, the cathode, and anode for the more common plating solutions is discussed. It is stated that whereas many spectacular claims have been made, they have not later been substantiated. The author concludes by agreeing with Delfs [Metalloberfläche, p. 266 (Sept., 1956)] that all effects of ultrasonic vibrations are based on a very effective stirring action which prevents too low ionic concentrations in the cathode films. It is predicted however that special applications will be found, especially when the price of equipment is reduced. 19 references.
A.P.C.Thiele

ELECTRIC HEATING

621.362

6696 THERMOELECTRIC AIR CONDITIONING OF TOTALLY ENCLOSED ENVIRONMENTS. G.D.Hudelson.
Elect. Engng, Vol. 79, No. 6, 460-8 (June, 1960).

In this study of thermoelectric air conditioning, the emphasis is on that part of the air-conditioning system which provides temperature and humidity control and on the loads imposed on such a system. The totally enclosed environment considered is that of a modern submarine designed for normal operation submerged for long periods of time.

621.362

6697 OPERATING PROPERTIES OF THERMOELECTRIC GENERATOR MATERIALS. M.G.Ryan and N.J.Stevens.
Elect. Engng, Vol. 79, No. 6, 470-5 (June, 1960).

A brief exposition of the thermodynamics of thermoelectricity and a discussion of the measurement techniques developed to provide quality control data for the selection of thermoelectric material.

621.362

6698 SYNTHESIS OF THERMOELECTRIC GENERATORS. M.E.Talaat.
Elect. Engng, Vol. 79, No. 6, 476-81 (June, 1960).

Presents a guide for the design of any thermoelectric generator to yield a given output for a given heat source and heat sink. The design procedure takes into account the Thomson effect, as well as the variations with temperature of the thermoelectric properties of a set of materials.

621.362

6699 DESIGN OF A 100-WATT THERMOELECTRIC GENERATOR.
T.M.Corry, W.C.Moreland and E.L.Strickland.
Elect. Engng, Vol. 79, No. 7, 482-8 (June, 1960).

Illustrates the practical problems encountered in utilizing thermoelectric materials now available to construct a 100 W, free-convection-cooled thermoelectric generator.

621.365

6700 ELECTRO-HEAT IN INDUSTRY. III. ELECTRIC FURNACES FOR THE HEAT TREATMENT OF METALS.
P.F.Hancock.
Elect. J., Vol. 164, No. 20, 1342-4 (May 13, 1960).

For Pt II, see Abstr. 3491 of 1960.

621.365

6701 ELECTRO-HEAT IN INDUSTRY. IV. THE CORELESS INDUCTION MELTING FURNACE. A.G.Allen.
Elect. J., Vol. 164, No. 24, 1642-6 (June 10, 1960).

For Pt III, see preceding abstract.

621.365

6702 ELECTRO-HEAT IN INDUSTRY. V. ARC FURNACES. A.G.Robiette.
Elect. J., Vol. 165, No. 3, 167-68 (July 15, 1960).
For Pt IV, see preceding abstract.

621.365

6703 ELECTRO-HEAT IN INDUSTRY. VI. ELECTRIC SMELTING PROCESSES. A.G.Robiette.
Elect. J., Vol. 165, No. 6, 228-30 (Aug. 5, 1960).
For Pt V, see preceding abstract.

621.365

6704 ELECTRO-HEAT IN INDUSTRY. VII. HEATING AS APPLIED TO THE WOOD TRADE. J.Pound.
Elect. J., Vol. 165, No. 9, 500-3 (Aug. 26, 1960).
For Pt VI, see preceding abstract.

621.365.51

6705 LOW-FREQUENCY INDUCTION FURNACES. M.G.Gibbs.
Elect. Rev., Vol. 167, No. 8, 317-22 (Aug. 19, 1960).
The three principal types of electrical induction furnace — channel, coreless and crucible — and their applications are described and compared. Various factors influencing the choice of a suitable unit are discussed.

ELECTRIC WAVES AND OSCILLATIONS

621.371

6706 IMPULSE EXCITATION OF A CONDUCTING MEDIUM. J.Galejs.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 227-8 (March, 1960).
The depth of penetration into a conducting medium, where sinusoidal surface excitations generate peak magnetic fields or derivatives equal to those of an impulse-type surface excitation, is calculated. Finite pulses generate fields similar to those of a surface impulse provided they are sufficiently short. The maximum permissible pulse duration is proportional to the square of the specified penetration depth. In order to exhibit minimum attenuation, the excitation fields must be unipolar over a time period comparable with the transient duration. Such fields may be generated within the induction field of the source.

621.371 : 538.56

6707 RECIPROCITY AND SCATTERING BY CERTAIN ROUGH SURFACES. W.S.Ament.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 167-74 (March, 1960).
Reciprocity theorems are developed for the average field specularly reflected, and the average power randomly scattered, to a point by a statistically described array of objects. A reciprocal quasi-variational expression for the average power is developed for use when the self-consistent method applies to calculating currents in the individual objects. This formula is applied to calculate differential scattering cross-sections for two idealized arrays bounded by plane "rough surfaces". General conclusions, relating to reciprocity, power conservation, grazing behaviour, etc., for rough surface scattering, are made and applied heuristically to show that grazing reflection and backscatter from the rough ocean should be independent of polarization.

621.371 : 534.26 : 538.56

6708 BACKSCATTERING FROM A FINITE CONE. J.B.Keller.
I.R.E. Trans Antennas Propagation, Vol. AP-8, No. 2, 175-82 (March, 1960).
Backscattering is calculated for an acoustic wave incident on a hard or soft finite cone, and for an electromagnetic wave incident on a perfectly conducting finite cone. Two shapes of cone are treated, one with the flat base and the other with a rounded base. The calculation is based on the geometrical theory of diffraction. It is probably valid for wavelengths as large as the cone dimesions or smaller. Graphs of the backscattering cross section versus cone angle and versus wavelength are given for axial incidence on the flat-based cone. Suggestions for shaping an object to minimize its backscattering are also included.

621.371

6709 ELECTROMAGNETIC TRANSIENTS IN CONDUCTING MEDIA. S.H.Zisk.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 229-30 (March, 1960).
In a recent paper (see Abstr. 4723 of 1958) Richards derived expressions for the electric and magnetic fields of a short pulse of electric or magnetic dipole moment in a conducting medium. An alternative analysis is given which explains certain unusual results of the original work as arising from dispersion in the conducting medium and from the frequency dependence of the attenuation factor of the fields. The conclusion drawn is that communication by pulses is expected to be inferior to that by low-frequency continuous waves.

621.371

6710 BACK SCATTERING CROSS SECTIONS OF CYLINDRICAL WIRES OF FINITE CONDUCTIVITY.
E.S.Cassedy and J.Fainberg.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 1, 1-7 (Jan., 1960).
The back-scattering cross-sections of fine wires, taking the effect of finite conductivity into account, were found. The variational procedure was used to find theoretical expressions for the cross-section and it is concluded that the zeroth and the first-order solutions of Tai (Abstr. 4618 of 1952) converge to one another with the addition of loss, in the region of first resonance. For fine copper, platinum and bismuth wires, experimentally determined cross-sections agree with the theoretical results calculated from the zero-order solution to within 4% in peak resonant values and 1.5% in bandwidth.

621.371

6711 HIGH-FREQUENCY DIFFRACTION OF ELECTRO-MAGNETIC WAVES BY A CIRCULAR APERTURE IN AN INFINITE PLANE CONDUCTING SCREEN.
S.R.Seshadri and T.T.Wu.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 1, 27-36 (Jan., 1960).
The scattering of plane electromagnetic waves of wave-number k by a circular aperture of radius a in an infinitely conducting plane screen of zero thickness and infinite extent is considered. In the limit of large ka and at normal incidence, the ratio of the transmission cross-section to the geometrical optical value π^2, is found up to the order $(ka)^{-5/2}$.

621.371

6712 HIGH-FREQUENCY DIFFRACTION OF PLANE WAVES BY AN INFINITE SLIT FOR GRAZING INCIDENCE.
S.R.Seshadri and T.T.Wu.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 1, 37-42 (Jan., 1960).
The scattering of plane electromagnetic waves of wave number k by an infinite slit of width 2a formed by two perfectly conducting coplanar screens of zero thickness is considered. In the limit of large ka and at grazing incidence, the asymptotic series for the transmission cross section per unit length of the slit is evaluated up to the order $(ka)^{-11/2}$.

621.371

6713 SCATTERING BY AN INFINITE ARRAY OF THIN DIELECTRIC SHEETS. R.E.Collin.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 1, 62-7 (Jan., 1960).
By replacing each dielectric sheet in an infinite array of thin dielectric sheets by an infinitely thin polarization current sheet, a solution for the scattering of plane waves by such an array is obtained. The simplified periodic boundary value problem is rigorously solved by using bilateral Laplace transforms. Numerical results obtained compare favourably with those obtained by the Rayleigh–Ritz method.

621.371 : 537.56

6714 SCATTERING OF ELECTROMAGNETIC WAVES FROM AN INFINITELY LONG MAGNETIZED CYLINDRICAL PLASMA. P.M.Platzman and H.T.Ozaki
J. appl. Phys., Vol. 31, No. 9, 1597-601 (Sept., 1960).

The magnetically contained plasma is characterized, in an average way, in terms of its macroscopic dielectric tensor. The problem of the scattering of plane electromagnetic waves from a uniform cylindrically symmetric plasma configuration is solved analytically. Numerical results for the uniform case are obtained and graphed for interesting ranges of the parameters involved. Possible applications of the results for use in investigating the plasma's properties are discussed.

LINES . NETWORKS . FILTERS

621.372

6715 AN EXTENSION OF HEAVISIDE'S EXPANSION THEOREM, WHEN ROOT EXPRESSIONS ENTER THE OPERATOR FUNCTION. H.Pleijel.
Tele (Swedish Edition), 1960, No. 1, 190-6. In Swedish.

Heaviside's expansion theorem gives a formula which can be used directly to obtain solutions of the Heaviside problem, when the operator function obtained is a unique function of p fulfilling Jordan's theorem. In many cases, this means that a partial solution is desired, e.g. for an outgoing or reflected wave, when the operator function contains a root expression and is not a unique function of p. A general rule is given for finding an expression which gives a supplementary term to the expansion formula, corresponding to the poles entering the operator function. G.N.J.Beck

621.372.2

6716 ANALYSIS OF CERTAIN TRANSMISSION-LINE NETWORKS IN THE TIME DOMAIN. W.J.Getsinger.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 301-9 (May, 1960).

Many linear components in nondispersive transmission line are made up solely of commensurate lengths of line of various characteristic impedances. Such components have impulse responses that are a series of equispaced impulses, and, as a result, their frequency responses can be written as a Fourier series. Given the period and coefficients of the Fourier series describing the frequency response, the time response of the circuit to any pulse can be written down immediately as a sum of replicas of the applied pulse, each replica having an amplitude given by the coefficient of a term in the series, and occurring at a time determined by the period of that term of the series. The pulse responses of stepped transmission-line transformers, backward-coupling hybrids, and branch-line hybrids are determined and, after assuming a simple applied-pulse shape, are plotted.

621.372.2

6717 A VARIATIONAL INTEGRAL FOR PROPAGATION CONSTANT OF LOSSY TRANSMISSION LINES. R.E.Collin.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 339-42 (May, 1960).

By assuming that the current on a lossy transmission line flows in an axial direction only, a variational integral for the propagation constant can be readily obtained. This variational integral shows that the usual power loss method of evaluating the attenuation constant is valid for general transmission lines. This variational integral also shows that the perturbation of the loss-free phase constant is due to the increase in magnetic field energy caused by penetration of the field into the conductors.

621.372.4

6718 LINEAR GRAPH THEORY-A FUNDAMENTAL ENGINEERING DISCIPLINE. H.E.Koenig and W.A.Blackwell.
I.R.E. Trans Educ., Vol. E-3, No. 2, 42-9 (June, 1960).

Presents the basis of an operational concept of system analysis embracing all types of systems, and presents an orderly, sure, and relatively simple basis for extending the discipline of linear graph theory (abstracted form of network theory) to the analysis and synthesis of all types of lumped-parameter systems without the artifice of analogies. It is indicated that these procedures and concepts also provide a means for extending electrical network theory beyond current applications to include systems of multi-terminal components.

621.372.412

6719 SETS OF EIGENVECTORS FOR VOLUMES OF REVOLUTION. J.Van Bladel.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 309-19 (May, 1960).

The electric and magnetic eigenvectors of a volume of revolution can be written of terms in two-dimensional scalar and vector functions. These functions are the eigenfunctions of certain linear transformations in the meridian plane. The form of the transformation is examined, and much attention is devoted to the orthogonality properties of their eigenfunctions and the calculation of their eigenvalues from variational principles.

621.372.412 : 534.13

6720 CONTOUR VIBRATIONS OF SQUARE THIN QUARTZ PLATES. A.Tachibana.
J. Inst. Elect. Commun. Engrs Japan, Vol. 43, No. 4, 573-9 (April, 1960). In Japanese.

An equation for the frequencies of the contour modes of vibration of square thin anisotropic plates has been given by Bechmann [See Abstr. 4965A of 1952; Proc. Phys. Soc. (Lond.) B, Vol. 65, 368-74 (May, 1952)]. Experimental results are here given for the frequency constants of quartz plates whose two flat surfaces are parallel to the X axis. The specimens tested were $Y_{\theta},0^{\circ}$, $Y_{38^{\circ}},\phi$, $Y_{90^{\circ}},\phi$ and $Y_{128^{\circ}},\phi$ cut plates, the values of θ ranging from 0° to 180° and those of ϕ from 0° to 45°. The results for 3 longitudinal modes and one shear mode are shown graphically, together with the values calculated from Bechmann's equation, the agreement between the experimental and calculated values being, in general, very good. Higher-order contour vibrations of $Y_{\theta},0^{\circ}$ cut plates are also discussed. A.Wilkinson

621.372.412 : 538.56

6721 FIELD MEASUREMENTS IN RESONANT CAVITIES. D.K.Callebaut and M.C.Vanwormhoudt.
Physica, Vol. 26, No. 4, 255-8 (April, 1960).

The percentage shift of the resonant frequency of a cavity, perturbed by a small metallic body at a point of zero magnetic field, is proportional to the volume of the perturbing body, and to the square of the normalized unperturbed electric field. It is shown that the proportionality factor is only dependent upon the shape of the body and upon the orientation of the field. When the perturbing object is a small cylinder having its axis parallel to the field, it will be a function of α, the ratio of the height to the radius of the cylinder. The knowledge of this dependence allows the electric field to be determined from a single perturbation measurement. The function has been determined experimentally and happens to be fairly linear for cylinders which are not too high compared with their radius.

621.372.412 : 621.317.34

MEASUREMENT OF BANDWIDTH OF MICROWAVE RESONATOR BY PHASE SHIFT OF SIGNAL MODULATION. See Abstr. 6651

621.372.413

6722 ON THE THEORY OF STRONGLY COUPLED CAVITY CHAINS. M.A.Allen and G.S.Kino.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 362-72 (May, 1960).

A chain of identical cavity resonators coupled together through slots in their common walls forms a band-pass microwave filter. The pass-band characteristics of such a system are determined by a combination of field theory and circuit theory. The fields in the cavities are expressed in terms of the normal modes of the uncoupled cavities. The fields in the neighbourhood of a slot are determined by representing the slot as a transmission line. Irrotational components of the field in the cavities account for direct slot-to-slot coupling. The method successfully predicts both the dispersion characteristics and field distributions over large frequency ranges for many practical systems, such as slow-wave circuits for high-power travelling-wave tubes.

621.372.413

6723 DESIGN OF HIGH-Q MICROWAVE CAVITIES. I. W.Otto.
Nachrichtentechnik, Vol. 10, No. 5, 205-9 (May, 1960). In German.

Maxwell's equations are solved for a cylindrical resonator and

conditions of resonance are derived. Various resonance modes are considered and some relevant design parameters are briefly analysed. A.E.Karbowiak

621.372.44

6724 APPROXIMATION AND SYNTHESIS OF DIPOLES. H.Debart.

Cables et Transm., Vol. 13, No. 3, 188-94 (July, 1959). In French.

The use of the Stieltjes transformation allows the impedance characteristic of the required network to be developed in the form of a continued fraction. The terms of the continued fraction coincide with the parameters of a general ladder network which can then be produced to provide the required characteristic. G.D.Sims

621.372.5 : 621.317.39 : 534.23

6725 THE DUALITY OF THE FOUR-TERMINAL NETWORK EQUATIONS OF ELECTROMECHANICAL TRANSDUCERS AND THEIR ELECTRICAL FOUR-TERMINAL EQUIVALENT CIRCUITS. J.Kacprowski.

Acustica, Vol. 8, No. 6, 379-86 (1958). In German.

Attention is drawn to the lack of uniqueness in the two-pole as well as four-pole theory of passive linear electromechanical transducers as regards their four-pole equations and corresponding equivalent circuits. The reason given for this is the duality of the electromechanical coupling factor. It is shown that the choice of a suitable coupling factor as well as of four-pole equations and corresponding equivalent circuits depends on determined polarization or loading conditions of the transducer concerned. Two possible four-pole equations and their two corresponding circuits holding for any passive and linear (linearized) electromechanical transducer are given. Attention is drawn to the fact that in the case of parallel or linear electric and magnetic transducers working in improper polarization or loading conditions the additional stiffness caused by the reaction of the electric or magnetic field is positive.

621.372.5

6726 ON A QUADRIPOLE TRANSFORMATION. J.Oswald.

Cables et Transm., Vol. 13, No. 3, 208-16 (July, 1959). In French.

A study of a transformation allowing the deduction from an arbitrary quadripole of a new quadripole with some complementary properties. The characteristic impedance is invariant under the transformation which transforms all antisymmetric quadripole filters into further antisymmetric quadripole filters. The effective transmission attenuation, and loss due to reflection, are interchanged by the transformation. Applied to active networks the transformation allows negative impedances of known value to be obtained and also demonstrates the relationship which exists between two terminal and four terminal repeaters with negative impedance. G.D.Sims

621.372.5

6727 A "DECIMAL" ATTENUATOR. A CONSTANT-RESISTANCE VOLTAGE OR CURRENT-DIVIDING NETWORK INDEXED IN DECIMALS. E.R.Wigan.

Electronic Engng, Vol. 32, 560-6 (Sept., 1960).

A network is described which combines the properties of a conventional voltage or current divider with those of a constant-resistance attenuator, retaining the most useful features of each while being free of their disadvantages. It will deliver at its output terminals precisely known decimal-fractions of its input voltage; for instance in a divider which has three decimal-dials the output/input ratio can be adjusted in 1000-steps of 0.001 from zero up to unity. The divider retains at all times a strictly constant output resistance; this means that current may be drawn from the output terminals without losing the ability to make precisely known adjustments of the output voltage or current, although the presence of the load will reduce the voltage or current available.

621.372.5

6728 PRECISE MEASUREMENT OF LARGE DYNAMIC RESPONSE CHARACTERISTICS OF AUDIO NETWORKS. D.S.Cochran.

J. Audio Engng Soc., Vol. 8, No. 3, 169-71 (July, 1960).

Measurements at audio frequencies are complicated by the presence of harmonics generated at the signal source, by harmonics produced in the network under test if the signal level is too high, and by problems from noise and hum if a signal level low enough to avoid harmonics is used. Various solutions are discussed. A single instrument is described which provides facilities that solve all phases of the problem of the precise measurement of the characteristics of audio networks.

621.372.5

6729 HIGH Q INDUCTANCE SIMULATION. J.E.Fulenwider.

Proc. Inst. Radio Engrs, Vol. 48, No. 5, 954-5 (May, 1960).

An improvement which can be made to the pentode simulation of reactance, particularly inductive reactance, is the elimination of the resistance component, with consequential enhancement of the Q-value towards infinity. Circuits for simulation which are described in the literature are referred to. The pentode circuit is analysed and a transfer function derived, expressible in terms of a series LCR circuit following a pentode. A practicable complete simulator circuit for positive inductance is shown, for a frequency range of 60 to 2000 c/s, and an equivalent magnitude range of 28 to 2800 henries, and having good linearity and low second harmonic. The possibilities of other two-terminal simulations with this type of circuit are indicated, including that of negative inductance. W.J.Mitchell

621.372.54

6730 SOME CHARACTERISTICS OF A VARIABLE TRANSMISSION NETWORK FOR AUDIO SIGNALS. J.Klapper and C.M.Harris.

J. Audio Engng Soc., Vol. 8, No. 3, 177-9 (July, 1960).

The transmission network described is comprised of a multiplicity of contiguous filters. The crossover points of the responses of adjacent filters are at the 3 dB down value. The inputs to all filters are connected together and their outputs terminate in an adder circuit. By providing an adjustable gain for each filter, a variable transmission characteristic is achieved. The filters were chosen to be Gaussian because this type of filter has an excellent transient response and a linear phase response. Some of the characteristics of the overall transmission system are discussed.

621.372.542

6731 SELECTING RC VALUES FOR ACTIVE FILTERS. R.E.Bach, Jr.

Electronics, Vol. 33, No. 2, 82-5 (May 13, 1960).

The Butterworth low-pass transfer functions are tabulated for orders up to 5, and RC networks with cathode followers are given, by means of which the desired transfer functions can be realized. The values of R and C can be determined by equating coefficients of the transfer functions. High-pass filters can be dealt with in a similar manner. W.G.Stripp

621.372.6

6732 MATRIX ANALYSIS OF CONSTRAINED NETWORKS. A.Nathan.

Proc. Instn Elect. Engrs, Monogr. 399 E, publ. Sept., 1960, 9 pp. To be republished in Part C.

Following a review of nodal analysis of unconstrained lumped linear time-invariant networks it is shown how networks with imposed unilateral constraints, i.e. transmittances and voltage sources, can conveniently be analysed by matrix methods. Their admittance matrix is equal to the product of a submatrix of the admittance matrix before the application of the constraints and a transmittance matrix which describes the constraints. Constraints lower the rank of the original admittance matrix, thus making the method quite attractive in practice. Applications included are a computing network, difference amplifiers, a d.c. amplifier and signal-flow graphs.

621.372.6.012.8

6733 A NEW APPROACH TO KRON'S METHOD OF ANALYSING LARGE SYSTEMS. R.Onodera.

Proc. Instn Elect. Engrs, Monogr. 403 E, publ. Oct., 1960, 8pp. To be republished in Part C.

Generally an electrical network is used as a model circuit for a physical field. This circuit is most complicated and the analysis of it is frequently difficult. "Diakoptics", introduced by Kron, is very effective for analysis of the network. The method entails the operation of "cutting", which is generally classified into open-circuiting and short-circuiting. The latter operation is the dual of the former, but, as far as the author is aware, has not yet been reported in any of the literature. A method is described, based on Kron's diakoptics, which uses the operation of open-circuiting, and is further extended to dual diakoptics treated by the operation of short-circuiting. Here a simplification of Kron's diakoptics is attempted and a dual method is introduced. It seems that this attempt goes backwards in tensor geometry, but forward in combinatorial topology. The first intention of the paper is to show the duality between diakoptics and codiakoptics.

621.372.6

6734 SYNTHESIS OF SWITCHING FUNCTIONS BY LINEAR GRAPH THEORY. W.Mayeda.
I.B.M. J. Res. Developm., Vol. 4, No. 3, 321-8 (July, 1960).

Techniques of linear graph theory are applied to the study of switching networks. The first part treats the relationships among paths and circuits in a graph which will give a simple method of analyzing switching networks. The necessary conditions are given for the realizability of switching networks consisting of the specified elements. The second part is the synthesis which is accomplished by the use of the decomposition of cut-set matrices.

WAVEGUIDES

621.372.8 : 621.395.74

LONG-RANGE COMMUNICATIONS OVER WAVEGUIDE LINES.
See Abstr. 5750

621.372.82

6735 SOMMERFELD AND HARMS–GOUBAU WAVEGUIDES FOR CM- AND MM-WAVELENGTHS. H.Severin.
Arch. elekt. Übertragung, Vol. 14, No. 4, 155-62 (April, 1960). In German.

The behaviour of a wire conductor, with or without dielectric coating, as a surface waveguide, is analysed in the region of frequencies where dimensions of the wire are comparable with the wavelength. Discussion of the extent of the field and attenuation as functions of frequency and guide parameters (wire diameter, thickness and permittivity of the dielectric coating) is based on a number of examples. With practical values of the field concentration, attenuation of the wire guide is smaller, by an order of magnitude, than that of hollow metal waveguides. If a limit is set of 3.5 dB/km, wire guides cannot be used for long-distance transmission below 5 cm wavelength. The application of wire guides involves a compromise between field concentration and attenuation.
J.M.Silberstein

621.372.821

6736 DISCONTINUITIES IN THE CENTER CONDUCTOR OF SYMMETRIC STRIP TRANSMESSION LINE.
H.M.Altschuler and A.A.Oliner.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 328-39 (May, 1960).

A systematic measurements programme was carried out to check the validity of theoretical formulae for the equivalent-circuit parameters of a variety of discontinuities in the centre conductor of symmetric strip transmission line. These theoretical formulae have been in part previously available and are in part new or modified. Results indicate that, in general, these formulae are adequate for most engineering purposes and that certain of the network parameters can be neglected.

621.372.822

6737 MICROPHONY IN WAVEGUIDE.
I.Goldstein and S.Soorsoorian.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 372-5 (May, 1960).

Describes the mechanism of phase modulation by waveguide in the presence of a high intensity acoustic field. X-band rectangular waveguide was studied to determine the following: (a) resonant frequency in a transverse vibrational mode; (b) means of minimizing phase modulation.

621.372.822

6738 A NOTE ON RECTANGULAR WAVEGUIDE WAVE IMPEDANCES. B.Z.Katsenelenbaum.
Radiotekhnika, Vol. 15, No. 5, 79 (May, 1960). In Russian.

To get the correct expression for the reflection coefficient at rectangular waveguide couplings, etc. the formula W = Cb/h should be used (and not W = Cb/ah), where W = wave impedance, a, b are major and minor sides of waveguide, h is wave number and C is independent of a and b.
D.E.Brown

621.372.823

6739 PROPAGATION ALONG UNBOUNDED AND BOUNDED DIELECTRIC RODS. I. PROPAGATION ALONG AN UNBOUNDED DIELECTRIC ROD. P.J.B.Clarricoats.
Proc. Instn Elect. Engrs, Monogr. 409 E, publ. Oct., 1960, 7 pp. To be republished in Part C.

Describes a method for evaluating the propagation coefficients of an unbounded lossless dielectric rod of infinite extent. The propagation coefficients are obtained as a function of the ratio of rod radius to free space wavelength, r_1/λ_0, for the three lowest modes of propagation possessing fields with θ dependence of the form $\epsilon^{\pm j\theta}$. The method of solution enables the form of the complete mode spectrum to be identified. It is also established that the product of the rod permeability and permittivity, $\mu\epsilon$, primarily determines the propagation behaviour; the ratio μ/ϵ has only a secondary effect. An expression is obtained for the distribution of transmitted power between the rod and the surrounding space, and it is also demonstrated that the product $\mu\epsilon$ primarily determines this quantity. Correlation between power distribution and attenuation is demonstrated for a rod possessing small losses.

621.372.831

6740 THE JOINT OF TWO DIFFERENT PLANAR WAVEGUIDES. N.P.Mar'in.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 3-11 (Jan., 1959). In Russian.

The problem of the incidence of e.m. waves on the joint of two semi-infinite waveguides, the walls of which lie along lines of different co-ordinate systems, is discussed. The problem is reduced to the solution of an infinite system of equations in which the unknown quantities are the amplitudes of the transmitted and reflected waves. The analytical results are used to investigate the incidence of H_{0n} waves on the joint of a rectangular and radial waveguide, corresponding to a widening of the waveguide in the E plane. The dependence of the reflection coefficient on the aperture angle of the radial waveguide is shown graphically.
R.C.Glass

621.372.832.8

6741 A Y-JUNCTION STRIP-LINE CIRCULATOR.
U.Milano, J.H.Saunders and L.Davis, Jr.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 346-71 (May, 1960).

The theoretical approach to the three-port symmetrical circulator is reviewed and presented in a form valid for the most general waveguide case. A strip-line Y-function circulator is described and the performance of different units in the band 800 to 1600 Mc/s is illustrated. The new type of device described offers, for the low-frequency region of the microwave spectrum, advantages of simple design, light weight, and great compactness with respect to the classical types. When operated with a permanent magnet is gives — in a bandwidth of about 4% — isolation greater than 20 dB, insertion loss ≤ 0.4 dB, and input v.s.w.r. ≤ 1.20.

621.372.852.34

6742 THE P-I-N MODULATOR, AN ELECTRICALLY CONTROLLED ATTENUATOR FOR MM AND SUB-MM WAVES. F.C.de Ronde, H.J.G.Meyer and O.W.Memelink.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 325-7 (May, 1960).

The construction and performance of a millimetre-wave modulator are described. The main part of the modulator consists of a p-i-n germanium structure inserted into a rectangular waveguide. A modulation depth of 11 dB could be obtained at frequencies up to 5 kc/s, this modulation being caused for the greatest part by attenuation.

OSCILLATORS . PULSE GENERATORS

621.373.4

6743 A LOW FREQUENCY NOISE GENERATOR.
N.T.Slater.
Electronic Engng, Vol. 32, 473-5 (Aug., 1960).

By means of a sampling technique 90% of the noise power present in a high frequency band is converted into low frequency noise. This enables a high output level at low frequency to be obtained without

the use of a high gain d.c. amplifier and its inherent drift characteristic. Simple and effective control keeps the source output constant and a method for accurate measurement of the final output power is described. The amplitude distribution of the output is equal to that of the primary noise source. The generator operates entirely by electronic means using no moving mechanical parts.

621.373.4

6744 A BEAT-FREQUENCY GENERATOR FOR AUDIO, ULTRASONIC, AND VIDEO FREQUENCIES. SINE-WAVE, SQUARE-WAVE, AND SWEPT OUTPUTS.
C.A.Woodward, Jr.
Gen. Radio Exper., Vol. 34, No. 2, 3-10 (Feb., 1960).

621.373.431.2

6745 A GRAPHICAL ANALYSIS OF THE BLOCKING OSCILLATOR. III. D.Chambers.
Electronic Engng, Vol. 32, 430-4 (July, 1960).

For Pt I and II, see Abstr. 4968 of 1960. In this final part, practical aspects are considered and a typical example is worked out to illustrate the proposed method of design.

621.373.44 : 539.1.07

6746 A FAST TRIGGER CIRCUIT.
F.J.M.Farley.
Nuclear Electronics Conference, Paris, 1958 Vol. I. (see Abstr. 4975 of 1960) p. 185-7.

See also Abstr. 5901 of 1958. The circuit uses positive feedback via a pentode used as cathode load. A version using double triodes and another with time resetting (pulse termination) by a delay line are given. W.G.Stripp

621.373.44 : 539.1.07

6747 A NEW METHOD OF PULSE TIMING APPLIED TO FAST COINCIDENCE WORK. W.Gruhle.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 189-93.

To avoid delay dispersion due to the dependence of triggering time on pulse amplitude, use is made of the fact that a Schmitt trigger circuit can be made to flop back at zero level. By double differentiation, the trailing edges of input pulses can be made to pass through zero at a common point, thus providing the necessary constant-delay triggering. The trailing edge of the Schmitt circuit output pulse is differentiated to trigger a coincidence pulse generator. W.G.Stripp

621.373.44 : 539.1.07

6748 PULSE GENERATOR AND MIXER FOR NUCLEAR RESEARCH. G.Guében.
Bull. Soc. Roy. Sci. Liege, Vol. 29, No. 5-6, 119-23 (May-June, 1960). In French.

A pulse generator capable of producing pulse shapes and their combinations such as can be expected in nuclear research (photomultiplier and Geiger–Müller counter outputs as well as coincident square waves) was required for testing of complicated control and test equipment. An extention to the Tektronix (Type 545) oscillograph and pulse generator satisfying these requirements is described. A.Sczaniecki

621.373.44 : 537.3

6749 PRODUCTION OF MILLIMICROSECOND CURRENT PULSES USING A PRESSURIZED SPARK GAP.
J.H.Adlam and L.S.Holmes.
J. sci. Instrum., Vol. 37, No. 10, 385-8 (Oct., 1960).

A pressurized spark gap has been designed to discharge a number of coaxial cables in parallel, thus producing a current pulse of 10^4 A with a rise of 4.5 mμsec. It is intended to use a number of these spark gaps in parallel, and to test the feasibility of doing this, measurements have been made of the statistical variation of the time lag for breakdown after triggering.

621.373.44

6750 TRANSISTOR MONOSTABLE CIRCUITS.
T.H.Brown and W.L.Stephenson.
Mullard tech. Commun., Vol. 5, 89-93 (April, 1960).

The main functions of monostable circuits are the provision of trigger delays and rectangular waveforms. In the performance of these functions, the principal characteristics which are of interest are stability of pulse length, maximum obtainable mark-to-space ratio and switching times. Methods of analysis by which these characteristics can be determined and the application of these methods to two practical circuits are given. Calculated results and measured values are compared and show fairly good agreement

621.373.51 : 621.382.232

6751 A TUNNEL DIODE CRYSTAL CALIBRATOR.
L.G.Cox.
J. Brit. Instn Radio Engrs, Vol. 20, No. 8, 621-3 (Aug., 1960).

A diagram showing the ratios of circuit constants for the five possible modes of operation of a series tunnel-diode circuit is given. A tunnel-diode crystal-calibrator with a relatively flat output in the h.f. band is described, and circuit details of a 100 kc/s or 1 Mc/s calibrator are given.

621.373.52

6752 A NOVEL SINGLE TRANSISTOR RC OSCILLATOR.
E.T.Emms.
Electronic Engng, Vol. 32, 506-8 (Aug., 1960).

A novel single transistor RC oscillator is described which will oscillate with the majority of low-frequency transistors even when the transistor current gain is at the lower limit. The circuit employs a modification of the parallel-T network. The effect of finite transistor input-impedance and output-capacitance is discussed.

621.373.52 : 621.314.5

6753 NEW HIGH POWER [TRANSISTORIZED] D.C. CONVERTER CIRCUITS. J.R.Nowicki.
Mullard tech. Commun., Vol. 5, 104-14 (April, 1960).

PULSE CIRCUITS . DIGITAL CIRCUITS SWITCHING CIRCUITS

621.374.3

6754 NOISE SUPPRESSION FOR DIGITAL SIGNALS.
F.W.Kear.
Electronics, Vol. 33, No. 29, 80 (July 15, 1960).

Noise problems caused by the association of electronic with electromechanical devices may be solved by the use of transistors operated in saturation. A method is described of generating good, standard shaped pulses from the closures of imperfect mechanical contacts. G.H.Stearman

621.374.3 : 539.1.07

6755 A NOVEL FAST COINCIDENCE CIRCUIT OF THE DICKE TYPE. W.F.Hornyak and H.Yoshiki.
Nuclear Electronics Conference, Paris, 1958.Vol. I. (see Abstr. 4975 of 1960) p. 195-200.

See also Abstr. 1183 of 1948. Pulses from two inputs are conveyed to a junction A by delay cables of lengths l_1 and l_3. From A two further cables of lengths l_2 and l_4 connect to a second junction B. If $l_3 - l_1 = l_4 - l_2 = l$, the Fourier spectrum of a single pulse from one input arriving at B will have amplitude zeros at frequencies $c(2n - 1)2\Delta l$. Thus a narrow band receiver connected to B will have no output. It is shown that, for coincident pulses at the inputs, not necessarily of the same amplitude or shape, there will be a component at B with a finite amplitude. The time $\Delta l/c$ should be long compared with input pulse durations. The preservation of a coincidence component depends on a suitable non-linear device between the junction B and the receiver. In the new development this is an overdriven distributed line amplifier. W.G.Stripp

621.374.3 : 539.1.07

6756 A NANOSECOND VERNIER ANALYZER.
C.Cottini, E.Gatti and F.Vaghi.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 177-83.

Pulses from two photomultipliers excite two resonant circuits (20 Mc/s and 20.2 Mc/s). The wave trains are mixed and the l.f. modulation product is passed to a phase detector and a time-to-amplitude converter. The ramp waveform used for the conversion is started by the arrival of a pair of quasi-coincident photomultiplier pulses and stopped by the first zero crossing of the modulation product. Some coincidence curves taken with the instrument are given. W.G.Stripp

621.374.3

6757 A SIMPLE CIRCUIT FOR PRODUCING A VOLTAGE PROPORTIONAL TO THE WIDTH OF A REPETITIVE PULSE. H.C.Bertoya.
Electronic Engng, Vol. 32, 442-3 (July, 1960).

A circuit is described which converts a repetitive pulse into a

direct voltage. The magnitude of the direct voltage is proportional to the width of the pulse. The need for the circuit arose when it was found that the pulse would not drive an integrating motor directly. The circuit is analysed and details of its performance, together with that of the integrator, are given.

621.374.3 : 621.387.42

6758 A PULSE INTEGRATOR FOR RADIOACTIVE MEASUREMENTS.

R.A.P.Gayoso, O.O.Ottolia and S.F.Pinasco.

Rev. Electrotec., Vol. 46, No. 2, 43-8 (Feb., 1960). In Spanish.

The integrator described is intended for use with Geiger or scintillation detectors and converts random pulses to a mean count over one minute. Ranges are from 300 to 10^5 counts/min in six steps. Four time-constants of 0.5, 2, 10 and 50 s are available independently of the range of count. Sensitivity is >5 mV. The amplifier has a gain of 10^3 and an input attenuator can reduce the amplification in steps of $\frac{1}{2}$ to 1000/8. The input impedance is 4000Ω. The power supply provides a voltage variable between 400 and 2500 V, stable to 1 in 5×10^{-4} and with less than 5 mV ripple. The accuracy is about 1%, zero stability is better than ±0.25%. Additional outputs of 1 mA and 10 mV are available for a pen recorder. Circuits for the complete equipment are given with a list of component values. J.S.Young

621.374.3 : 621.396.6

6759 INSTRUMENTATION FOR COMPLEX SIGNAL ENVIRONMENT TESTING. D.Kreuger and G.Herlt, Jr.

I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 13-18 (June, 1960).

Describes a simulation programme and equipment developed to facilitate the environmental testing of new receiver, data processing, and display systems without costly, time-consuming field tests. The simulator system permits simulation of high-density-signal areas, complex pulse-type modulations, and the effects of bandwidth suppression when magnetic-tape recorders are employed.

621.374.3

6760 A PULSE INTERVAL MONITOR. F.Lee.

Sylvania Technol., Vol. 13, No. 2, 66-9 (April, 1960).

A relatively simple and inexpensive circuit is described that measures the interval between two pulses with good accuracy. The circuit combines the desirable features of both vacuum tubes and transistors. The main feature of the monitor is a one-transistor linear sweep generator that utilizes the constant-current characteristics of a transistor.

621.374.3 : 621.317.34

MILLIMICROSECOND PULSE INSTRUMENTATION FOR MICROWAVES. See Abstr. 6652

621.374.32 : 539.1.07

6761 AUTOMATIC RANGE-CHANGING OF A LINEAR RATEMETER. S.Lovett.

J. sci. Instrum., Vol. 37, No. 10, 376-8 (Oct., 1960).

A circuit is described which automatically changes the range of a linear ratemeter as the count rate from a flow Geiger counter increases or decreases. The counter voltage is switched off when the count rate exceeds the maximum that the counter is designed to accept and is switched on at intervals to sample the count rate and remains on when the rate has diminished to an acceptable level.

621.374.32 : 539.12

6762 AN ELECTRONIC APPARATUS FOR THE STUDY OF X-RAYS WITH PROPORTIONAL COUNTER. N.Patla.

J. sci. Instrum., Vol. 37, No. 10, 388-93 (Oct., 1960).

The design and construction of an electronic pulse recording system for use with a proportional counter suitable for X-ray studies is described. The performance of the high gain amplifier and pulse amplitude analyser for X-ray wavelength discrimination is discussed in detail.

621.374.32

6763 COMPLEMENTARY TRANSISTOR CIRCUITS. F.Oakes and C.Thompson.

Electronic Engng, Vol. 32, 438-42 (July, 1960).

The availability of n-p-n as well as p-n-p transistors has led to the development of complementary techniques. A number of circuits useful for pulse and digital applications are described. Several of these have no thermionic valve circuit equivalent, and provide faster operation or greater flexibility than could be obtained with only one single operating polarity.

621.374.32

6764 A SILICON TRANSISTORIZED SCALING STAGE. L.B.Gardner.

I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 55-9 (June, 1960).

Presents the design, packaging, and evaluation of a scaling stage which utilizes silicon compounds for the semiconductor elements, thereby achieving stable operation at temperatures in excess of 110°C. The relative advantages and disadvantages of operating the semiconductors in the saturated or nonsaturated region is discussed and several practical circuits of each type are given. From laboratory measurements it appears that for a nonsaturated fast flip-flop the output transient response is independent of the input transient response. An hypothesis for this phenomenon is given along with the description and conclusions of controlled experiments designed to test the hypothesis. Several circuits were examined which differed only in the manner in which saturation was prevented; in all of the devices, only readily available production components were employed. The finally evolved unit is characterized by output rise and fall times of 15 mμs or less, a delay time of less than 20 mμs for pulse triples. Photographs, circuit diagrams, and typical waveforms of this unit are presented, along with applications of the device to nuclear instrumentation and computer logic.

621.374.32

6765 BATTERY-POWERED PORTABLE SCALER. F.E.Armstrong.

Electronics, Vol. 33, No. 19, 74-5 (May 6, 1960).

A simple design for quantitative measurements in field radioactive-tracer studies. Incorporates a binary scale-of-64 circuit driving a 4-digit mechanical register, a regulated high voltage supply and a pulse amplifier. The transistor scaling stages are non-saturating and temperature compensated, while the high-voltage power supply is a conventional blocking oscillator circuit providing voltage either variable or regulated at 900, 1000 or 1100 volts. The maximum driving rate of 600 counts per minute of the register combined with the scale-of-64 counter corresponds to a scaling rate of nearly 40 000 counts per minute, well beyond the useful scaling frequency of most G-M tubes. Timing is by means of an ordinary stop-watch. W.J.Mitchell

621.374.32 : 681.142

6766 REGULAR EXPRESSIONS AND STATE GRAPHS FOR AUTOMATA. R.McNaughton and H.Yamada.

I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 39-47 (March, 1960).

Algorithms are presented for (1) converting a state graph describing the behaviour of an automaton to a regular expression describing the behaviour of the same automaton (section 2); and (2) for converting a regular expression into a state graph (sections 3 and 4). These algorithms are justified by theorems, and examples are given. The first section contains a brief introduction to state graphs and the regular-expression language.

621.374.32

6767 HIGH-SPEED SEMICONDUCTOR SWITCH AND TRIGGER FOR ELECTRONIC COMPUTERS.

Ya.N.Bapat and I.L.Kaganov.

Elektrichestvo, 1960, No. 6, 76-81 (June). In Russian.

A description is given of a high-speed semiconductor switch. A trigger based on this design can achieve switching frequencies of 10 Mc/s and more. The speed of operation, the design of the elements, load capacity, and thermal stability are discussed.

Associated Electrical Industries (Manchester)

621.374.32 : 681.142

6768 THE ELLIOTT SHEFFER STROKE STATIC SWITCHING SYSTEM. P.Kellett.

Electronic Engng, Vol. 32, 534-9 (Sept., 1960).

A system is described in which interconnections between a number of logic elements, all of the same type (the Sheffer Stroke) permit any logical configuration or switching sequence. The simple rules which restrain the interconnections are stated. A number of basic interconnections of general use are described and a comparison made between the "Sheffer Stroke", the "nor" and the better known "and", "or", "not" logic elements. Available power switches are described. These may be controlled by the output of a logic element. Provision is made for connecting the loads in a matrix with considerable economy.

621.374.32 : 681.142

6769 REPRESENTATIONS OF SWITCHING FUNCTIONS AND THEIR APPLICATION TO COMPUTERS. H.J.Heijn.
University of Delft Dissertation (1960) 79 pp.

After some preliminary explanations and definitions, two methods of representing switching functions are derived. In the first of these the representation consists of a linear combination of the variables of the switching function and in the second, which is always possible, the representation is the algebraic sum of logical sums of the variables. The remaining chapters are concerned with a description of the logical behaviour of magnetic cores and the design of various parts of a computer using Renwick's word-organized system. There is a particularly full examination of the carry sequence in an adder and it is shown how to make a fast binary adder by dividing it into segments from the carry point of view.

G.A.Montgomerie

621.374.32 : 681.142

6770 PARAMETRON COMPUTER CIRCUITS. K.Nagamori.
Electronics, Vol. 33, No. 23, 73-8 (June 3, 1960).

Discusses the characteristics of parametrons and their bistable property with respect to oscillating phase, which allow their use as a binary logical element. Describes the coupling of parametrons to give unidirectional data flow with three-phase 2 Mc/s excitation which allows "keying" frequencies of 10-30 kc/s. A symbolic representation of the basic circuit is introduced and circuit implementation of the logical functions "and", "or" and "not" is given. It is shown how complicated computer circuits such as shift registers, adders, multipliers, counters, code convertors and translators are constructed from the basic logical blocks. Input–output translation between voltage or current and parametron phase is briefly described.

D.J.Truslove

621.374.32 : 681.142

6771 THE PARAMETRON AND ITS USE IN INFORMATION PROCESSING SYSTEMS. E.Schmitt.
Elektron. Rdsch., Vol. 14, No. 2, 41-6 (Feb., 1960). In German.

Basic principles of the parametron possessing variable inductance or capacitance are discussed. This is followed by a reasonably detailed mathematical treatment yielding a second-order differential equation, the solutions of which are given and discussed showing that the parametron is capable of amplification and storage of information. Applications described include parametrons used as storage elements, in logic circuits, connected as a flip-flop and used in conjunction with a ferrite-core storage matrix. Maximum obtainable performances and probable future developments are discussed. 18 references.

M.Goldberg

621.374.32 : 681.142

6772 THE DETERMINATION OF CARRY PROPAGATION LENGTH FOR BINARY ADDITION. G.W.Reitwiesner.
I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 35-8 (March, 1960).

It is well known that the expected maximum length of nonzero carry propagation in the addition of two uniformly distributed binary numbers of n-digits each is less than $\log_2 n$. The propagation of both zero and nonzero carry is required in the employment of asynchronous self-timing addition. For the addition of two n-digit binary numbers which are uniformly distributed, a simple recursive algorithm is readily derived for the exact determination of the expected maximum length of zero or nonzero carry propagation.

621.374.32 : 621.318.57

6773 ELECTRONIC SWITCH CLOSING AND OPENING A CIRCUIT AT CONTROLLABLE INSTANTS.
R.Dehors, G.Seguier and C.Maizières.
C.R. Acad. Sci. (Paris), Vol. 250, No. 26, 3972-3 (June 13, 1960). In French.

Describes the operation of a control circuit comprising a source of direct current and a thyratron connected in series across the opposite terminals of a bridge of four diodes. The diodes are allowed to conduct between two exactly predetermined instants, so that current flows from the a.c. source through the load to the other two terminals of the bridge; a second thyratron is used to turn off the first. The prototype controls a 1 A 120 V circuit.

E.F.Hansford

621.374.32

6774 USE OF A TRANSISTOR FOR SETTING A SQUARE LOOP MAGNETIC CORE. I.Krajewski.
Electronic Engng, Vol. 32, 509-11 (Aug., 1960).

After showing that most available transistors have to be regarded as voltage sources when setting cores, an analysis of the basic circuit for setting a core is given; this shows that, under given conditions, for fastest setting there is an optimum number of turns for the setting winding. An experimental verification of these results is given which shows quite good agreement with calculation. A practical circuit is briefly described together with calculations of the junction power dissipations within the transistor used.

621.374.32

6775 THE DESIGN OF DIODE–TRANSISTOR NOR CIRCUITS. D.P.Masher.
I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 15-24 (March, 1960).

Considerations leading to the adoption of diode–transistor "nor" circuitry for a moderately fast data-processing system are outlined. The design of the basic circuit is treated in detail. Development of a unique set of compatible logic packages from the basic circuit is described. This set is unique in the sense that a single type of diode-transistor circuit is used to provide the great majority of logic and storage functions required in the system. This single circuit type, which functions as a "nor" circuit, is embodied in two package types. One package provides a single gate with a fan-in of five. The other package provides two gates, each with a fan-in of two. The latter type may be externally connected to provide a set–reset flip-flop. Only two other package types are used. The first is a passive transfer circuit which greatly simplifies shift register logic, and the second is a delay package which is closely related to the basic "nor" circuit.

621.374.32 : 681.142

6776 A METHOD FOR THE DESIGN OF PATTERN RECOGNITION LOGIC. S.D.Stearns.
I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 48-53 (March, 1960).

The general problem of pattern recognition is regarded as a problem wherein the recognition device is presented with a plane array of black-or-white elements and must decide to which general class (pattern) this array belongs. A method for reducing the necessary amount of logic is presented. It is basically a method for reducing Boolean equations in many variables which contain large numbers of redundant or "don't care" terms. The reduced logic is in the form of Boolean functions of the black-or-white elements. Some experimental results, in which this logic was mechanized with diodes, are discussed.

621.374.32 : 518

6777 CIRCUITS TO INCREASE THE SPEED OF CARRY PROPAGATION IN PARALLEL ADDERS. L.Dadda.
Nuovo Cimento Suppl., Vol. 15, No. 2, 169-80 (1960). In Italian.

The problem of carry propagation in parallel adders for digital computers is outlined. Various methods proposed and used to reduce the delay in carry propagation are discussed. A new method is described that uses switching elements which behave like relays, e.g. transistors.

H.Morrison

621.374.32 : 681.142

6778 PHYSICAL VERSUS LOGICAL COUPLING IN MEMORY SYSTEMS. J.A.Swanson.
I.B.M. J. Res. Developm., Vol. 4, No. 3, 305-10 (July, 1960).

A memory system consisting of bistable static dissipationless units such as ferrites, ferroelectrics, or cryotrons is considered. For a given amount of physical material the memory capacity may be increased by using small volumes of the bistable material for each bit. If made sufficiently small, however, the individual bits will become unreliable because of the influence of thermal agitation and quantum-mechanical tunnelling processes. Some unreliability can be tolerated, since it can be compensated by redundancy. The optimum size of the individual bit, for maximum information storage, is evaluated. If thermal agitation is the prime source of errors, then the optimum-sized bit involves typically less than 100 of the independent cooperating units (electron spins, dipoles, etc.) which cause the bistability. The maximization process concerns itself only with the preservation of information and not with possible methods of access to the individual bit. In particular, the maximization process neglects complications in the coding equipment needed to read in and out of memory.

621.374.32

6779 TRANSISTOR-CAPACITOR SHIFT REGISTER. R.W.Hofheimer.
Semiconductor Prod., Vol. 3, No. 7, 31-2 (July, 1960).

A shift register is described in which capacitors are used as the information storage elements. The chief advantages are circuit simplicity and high bit rate capability.

621.374.32 : 621.316.72

6780 A TRANSISTOR SWITCHING CIRCUIT FOR POWER REGULATION APPLICATIONS. M.J.Wright.
Electronic Engng, Vol. 32, 484-7 (Aug., 1960).

A d.c. transistor amplifier circuit for power control applications is described. Positive feedback is used to make the amplifier oscillate continuously, the output stage being switched between bottomed and cut-off conditions. The input signal modulates the mark-to-space ratio and so varies the mean current fed to an inductive amplifier load. The primary application considered for the circuit is voltage control of shunt fed dynamos of alternators, but its use in mains or battery-driven regulated power supplies is briefly mention. The principal advantages of a switching amplifier are (1) high efficiency and (2) low power dissipation in the series control transistor.

621.374.32 : 681.142

6781 CHEMICALLY DEPOSITED NiCo LAYERS AS HIGH-SPEED STORAGE ELEMENTS.
R.J.Heritage and M.T.Walker.
J. Electronics and Control, Vol. 7, No. 6, 542-52 (Dec., 1959).

Layers of NiCo were prepared by chemical reduction and their possible application for high-speed memory elements was examined. Switching constants of 0.15 μsec Oe were achieved on layers with domain wall coercivities of about 2Oe and the process appears to give reproducible results. The method is simple and inexpensive and should be adaptable to the production of storage elements in large numbers.

621.374.32 : 681.142

6782 AN IMPROVED FILM CRYOTRON AND ITS APPLICATION TO DIGITAL COMPUTERS.
V.L.Newhouse, J.W.Bremer and H.H.Edwards.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1395-404 (Aug., 1960).

A crossed-film cryotron deposited on an insulated superconductor is described and analysed. It has a time constant <1 μs and is approximately 100 times faster than the original crossed-film cryotron (see Abstr. 6462 of 1959). The d.c. dissipation is <5 μW and the active area of each element is approximately 5×10^{-4} cm^2. These cryotrons and all their interconnecting circuitry can be deposited at one and the same time in a few simple steps. A cryotron storage circuit and a shift register is described, based upon a principle unique to superconductors. The shift register shown is deposited in an area corresponding to 18 000 active elements/ft^2. Calculations are presented to show that with this component density, a computer or memory containing more than 10^6 elements can be operated in a 1 ft^3 container using a 1W output liquid-helium refrigerator.

621.374.32 : 621.318.57

6783 A DIODE MATRIX COMMUTATOR WITH TRANSISTOR FLIP-FLOP SWITCHING. S.L.Robinette.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 40-2 (June, 1960).

Eight input voltages are sequentially connected to a single output terminal through a diode matrix which is controlled by three cascaded flip-flops. Linearity is ± 1.0% for input voltages to 3 V; switching transient durations are 2.5 μs; switching rates of 50 kc/s are practical. The use of general-purpose germanium switching elements yields a relatively low-cost device.

621.374.42

6784 FREQUENCY DIVISION CIRCUITS FOR MUSICAL INSTRUMENTS. A.Douglas.
Electronic Engng, Vol. 32, 546-9 (Sept., 1960).

The distinguishing features of this class of circuit are, the division factor is always two; the maximum simplicity, for economic reasons; and the requirement that the waveform should be suitable for steady tone synthesis. It is difficult to meet all these conditions in a simple circuit.

621.374.32 : 621.317.714

AN AUTOMATIC DIGITAL RECORDER FOR IMPELLER-TYPE CURRENT-METERS. I-II. See Abstr. 6669

621.374.42

6785 FREQUENCY-DIVIDER WITH DIRECT LOCKING. T.S.Fedosova and K.A.Samoilo.
Radiotekhnika i Elektronica, Vol. 4, No. 1, 43-53 (Jan., 1959).
In Russian.

The theory of frequency-dividers using an LC circuit and those using a relaxation oscillator and an LC circuit is examined. The effect of phase-shift in the feedback circuit and anode reaction on the operating conditions of the divider are considered. The dependence of the dividing band on the form of the synchronising and step pulses is also investigated. R.C.Glass

621.374.5

6786 TRANSISTORISED MAGNETOSTRICTIVE DELAY-LINE STORES. H.A.Showell, C.W.M.Barrow and R.E.Collis.
A.E.I. Engng Rev., Vol. 1, No. 2, 58-67 (July, 1960).

The two types of magnetostrictive delay-line stores were developed for use in telephone exchange equipment and for possible application in other data-processing fields. Both stores operate reliably at a repetition rate of 1 Mc/s and an ambient temperature of up to 45°C. They have delay times of 100 μs and 1 ms and will store 100 and 1000 binary digits respectively. The circuits employ transistors and crystal diodes, and the compact plug-in units use printed wiring. See also Abstr. 3591 of 1960.

AMPLIFIERS

(Abstracts on magnetic amplifiers appear also under Inductors . Reactors)

621.375.2

6787 LIMITATIONS IN SQUARING WITH SIMPLE VALVE CIRCUITS OF WIDE BANDWIDTH.
R.M.Huey and J.E.Longfoot.
Electronic Engng, Vol. 32, 425-8 (July, 1960).

The errors to be expected from squarers using both curvature of a valve transfer characteristic and anti-phased inputs to separate control electrodes, are compared. The former are obtained from a theoretical analysis and the latter from measurement.

621.375.2

6788 A NEW D.C. GALVANOMETER AMPLIFIER. D.H.Jones.
Instrum. Pract., Vol. 14, No. 8, 869-79 (Aug., 1960).

An amplifier is described which was primarily designed to accept small zero-frequency voltages at a high impedance level, and to convert them into corresponding currents, at a much lower impedance level, of sufficient magnitude to operate a galvanometer. An account is given of the problems encountered and of the methods used to overcome them.

621.375.2

6789 PHOTO-SENSITIVE RESISTOR IN AN OVERLOAD-PREVENTING ARRANGEMENT. J.Rodrigues de Miranda.
J. Audio Engng Soc., Vol. 8, No. 3, 159-61 (July, 1960).

The signal from a preamplifier or tuner is supplied to the input terminals of the power amplifier by means of a voltage dividing network, the element in parallel to these input terminals being a photo-sensitive resistor (see Abstr. 386 of 1960). Facing this photo-resistor in a light-proof enclosure is a neon lamp connected to the output of the amplifier. A neon lamp ignites at a fixed voltage, and the value of the photo-resistor resistance begins to decrease as this voltage is reached. Consequently, the input signal to the amplifier is also decreased, making overload substantially impossible.

621.375.2

6790 A LOW-DISTORTION VOLUME EXPANDER FOR HOME USE. R.J.Matthys.
J. Audio Engng Soc., Vol. 8, No. 3, 199-205 (July, 1960).

The proper design of a volume expander is discussed. The problems of feedback, low distortion, linear expansion, maximum thump cancellation, and attack and decay-time selection are covered in detail. The performance of an expander built using the design ideas discussed is given. The expander has 19 dB of expansion and a 0.5 msec attack time.

621.375.23 : 621.317.32

6791 THE DESIGN OF AN AUDIO-FREQUENCY AMPLIFIER FOR HIGH-PRECISION VOLTAGE MEASUREMENT.
S.Harkness and F.J.Wilkins.
Proc. Instn Elect. Engrs, Paper 3335 M, publ. Oct., 1960, 8 pp. To be republished in Vol. 108B (1961).

The specification and design of an amplifier required for precision audio-frequency measurements is discussed. Formulae are presented for the "ring of three" feedback circuit and a detailed analysis is made of appropriate feedback theorems. A multi-gain amplifier which extends the voltage range of the electrostatic voltmeters, used at the N.P.L. as basic a.c./d.c. transfer instruments, is described. An increase in this range of up to 1000 times is provided and enables voltages between 60 mV and 60 volts in the frequency range 30 c/s–30 kc/s to be measured to a few parts in 10^4.

621.375.232.3

6792 HIGH PERFORMANCE IMPEDANCE TRANSFORMATION WITH THE EFP-60 SECONDARY-EMISSION PENTODE. N.S.Nahman and E.J.Martin, Jr.
I.R.E. Trans Electron Devices, Vol. ED-7, No. 2, 99-104 (April, 1960).

The unique characteristics of the EFP-60 secondary-emission pentode make it possible to utilize this tube in a novel cathode-follower circuit in which the impedance transformation action is "enhanced" by connection of the secondary-emission dynode back to the cathode. An analysis of this circuit in two slightly different forms indicates the possibility of achieving cathode-follower action with virtually unity gain and consequently high input-to-output impedance transformation ratio. The results of the analysis are verified by experimental data. Some aspects of the circuit as applied to millimicrosecond pulse work are discussed, and conclusions are reached with respect to optimization of tube characteristics for this particular type of application.

621.375.232.3 : 537.7

6793 ULTRALINEAR CATHODE FOLLOWER.
P.L.Read.
Rev. sci. Instrum., Vol. 31, No. 9, 979-82 (Sept., 1960).

The design of a modified cathode follower circuit which possesses an extremely linear response and a voltage gain of essentially unity is presented. Analysis of the circuit shows that, in principle, the harmonic distortion may be made arbitrarily small, and at the same time the voltage gain may be made arbitrarily close to unity. The modification is applied to a White cathode follower where the increase in linearity and gain is accompanied by a decrease in the output impedance. A practical modified White follower having a measured intermodulation distortion of 2×10^{-5}%, a calculated voltage gain of $(1\text{-}10^{-6})$, and a calculated output impedance of 2×10^{-3} ohms is given.

621.375.3

6794 SPECIAL TECHNICAL CONFERENCE ON NONLINEAR MAGNETICS AND MAGNETIC AMPLIFIERS.
New York: The American Institute of Electrical Engineers, Publication T-116 (Sept., 1959) 383 pp.

Papers presented at the Special Technical Conference held in Washington, D.C., Sept. 23-25, 1959, and sponsored jointly by the A.I.E.E. Committee on Magnetic Amplifiers and the Professional Group on Industrial Electronics of The Institute of Radio Engineers. Abstracts of these papers will appear in subsequent issues of Electrical Engineering Abstracts.

621.375.3

6795 AN ANALYSIS OF FOUR-FREQUENCY NONLINEAR REACTANCE CIRCUITS. D.K.Adams.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 274-83 (May, 1960).

Several advantages of multiple-frequency nonlinear reactance circuits are described. In particular, a circuit is considered in which a nonlinear reactance couples four basic frequencies: ω_0, ω_1, ω_2, and ω_3; these are so related that $\omega_2 = \omega_0 + \omega_1$ and $\omega_3 = \omega_0 - \omega_1$. Here ω_2 is taken to be the power source or pump. It is found to be desirable to allow for the possible presence of the pump harmonic, $2\omega_0$, and individual cases are characterized by whether $2\omega_0$ is present or not. The major results are as follows: (1) unlimited amplification gain is theoretically possible at frequencies higher than the pump, by reflecting negative input resistance at ω_3, but without relying on any effects due to pump harmonics: (2) unlimited up- or down-conversion gains between ω_1 and ω_2 are theoretically possible in the additional presence of the first pump harmonic, but without reflecting negative input or output resistance: (3) unlimited amplification gain is theoretically possible at frequencies both lower and higher than the pump fundamental, without reflecting negative input resistance.

621.375.4

6796 A NEGATIVE CAPACITANCE PRE-AMPLIFIER FOR ELECTROPHYSIOLOGICAL USE.
B.M.Johnstone and I.D.Pugsley.
Electronic Engng, Vol. 32, 422-4 (July, 1960).

A positive feedback circuit, giving negative input capacitance, is analysed. The limitations of frequency response are discussed. A transistorized amplifier has been developed to test the theory and indicate other practical limitations.

621.375.4 : 621.317.7

6797 A SENSITIVE TRANSISTOR RECORDING-PEN AMPLIFIER. K.G.Beauchamp.
Electronic Engng, Vol. 32, 444-5 (July, 1960).

It is shown that if a recording pen movement is connected in a bridge circuit in which two arms of the bridge consist of transistor elements, then high sensitivity can result. With this arrangement a constant current is drawn from the supply source and since this need not exceed the maximum pen driving current then low transistor power dissipation, and hence low temperature drift, can result.

621.375.4

6798 AN INTEGRATING AND DIFFERENTIATING AMPLIFIER FOR USE IN VIBRATION MEASUREMENTS.
M.Kringlebotn.
Electronic Engng, Vol. 32, 504-5 (Aug., 1960).

The signal source in the vibration measurements is assumed to be a velocity pick-up, and the amplifier output is delivered to a low-impedance load (e.g. a galvanometer with 25Ω internal resistance). When used as an integrator the amplifier converts the input velocity signal to a signal which indicates the displacement and, when used as a differentiator, to a signal which indicates the acceleration of the pick-up. The amplifier may also be used for linear amplification of the velocity signal. The amplifier stages are stabilized with respect to temperature changes. The additional feedback also contributes to thermal stability. A single 12.6V source is used.

621.375.4

6799 A SIGNAL BIASING OUTPUT TRANSFORMERLESS TRANSISTOR POWER AMPLIFIER. R.C.Heyser.
J. Audio Engng Soc., Vol. 8, No. 3, 185-92 (July, 1960).

A simple output transformerless transistor power amplifier is developed which, through the expedient of extracting a small amount of stored loudspeaker energy when required, is capable of delivering low subjective distortion to a loudspeaker system while maintaining an electrical operating efficiency approaching that of a conventional Class B amplifier.

621.375.422

6800 D.C. AMPLIFIER WITH BALANCED CHOPPER.
S.Guennou and H.Kemhadjian.
Mullard tech. Commun., Vol. 5, 97-103 (April, 1960).

A balanced chopper is designed with which very low direct voltages, of either polarity, may be amplified from low-impedance sources. A circuit is described for a complete d.c. amplifier using this chopper.

621.375.552

6801 CONSTANT-IMPEDANCE AMPLITUDE EQUALIZERS.
J.Bimont.
Cables et Transm., Vol. 13, No. 3, 157-87 (July, 1959). In French.

The equalizers studied are those with purely reactive inverse arms. Families of curves are given, with coordinates which are functions of the attenuation of the delay line and of the compensating attenuation, for various parameters and degrees (number of reactive elements). For equalizers of the 1st and 2nd degrees, the problem of specification is studied at length, starting from the attenuation to be compensated, and using superposition of curves. Variation of attenuation resulting from changes of various parameters is covered by further families of curves. W.G.Stripp

621.375.9 : 538.56

6802 SOME CHARACTERISTICS OF A MASER AT 1420 MHz. B.Bölger, B. J.Robinson and J.Ubbink.

Physica, Vol. 26, No. 1, 1-18 (Jan., 1960).

A regenerative solid-state maser has been constructed for 1420 Mc/s using 0.05% Cr^{+++} in $K_3Co(CN)_6$ and a pump frequency of 3850 Mc/s. With a magnetic field of 480 Oe at 11° to the crystalline a-axis in the ac-plane, the 1-2 transition was used for the signal frequency and the 1-3 transition for the pump frequency, numbering the levels in order of increasing energy. The product of voltage gain and bandwidth was $2.7 \times 10^8 s^{-1}$. Weaker emission was observed for several other transitions. For ruby (Cr^{+++} in Al_2O_3) emission could be produced for the 2-3 transition at 1420 Mc/s with the 1-3 transition pumped at 8500 Mc/s; for the 1-2 transition at 1420 Mc/s in ruby, with the 1-3 transition pumped at 10700 Mc/s, only a short pulse of emission could be produced. The emission for Cr^{+++} in $K_3Co(CN)_6$ was found to be much higher when the pump field extended throughout the crystal than when it had a node within the crystal. This observation suggests that in $K_3Cr(CN)_6/K_3Co(CN)_6$ the phonon saturation mechanism proposed by Strandberg (Abstr. 4654 of 1957) does not take place.

621.375.9

6803 THEORY OF PARAMETRIC AMPLICATION WITH DIODES. F.Dachert.

Ann. Radioelect., Vol. 15, 109-19 (April, 1960). In French.

A discussion of the synthesis of parametric amplifiers with attention paid to the general question "given a diode acting as a nonlinear capacitance, what linear circuit must be associated with it to produce an amplifier?". The approach is general covering the cases of up- and down- converters as well as negative-resistance amplifiers. An expression for the noise figure is derived for the latter case. G.D.Sims

621.375.9 : 538.56

6804 SOME POSSIBLE ARRANGEMENTS OF PARAMETRIC AMPLIFIERS EMPLOYING LOWER FREQUENCY PUMPING. N.B.Chakrabarti and K.D.Dikshit.

Indian J. Phys., Vol. 33, No. 10, 431-51 (Oct., 1959).

An analysis of certain parametric amplifiers using lower frequency pumping in lumped constant circuits is presented. Two cases (i) combination of a mixer and an amplifier using one pump and two idlers and (ii) combination of a mixer and an amplifier using two pumps and two idlers, have been treated in detail. The phase and power relations at signal frequency, pump and idling frequencies have been discussed. The expressions for negative resistance, gain, bandwidth and noise figure for each case have been derived. Two other possible cases have been mentioned. It is shown that the multi-idler circuits offer no added advantage.

621.375.9

6805 A WIDE-BAND U.H.F. TRAVELING-WAVE VARIABLE REACTANCE AMPLIFIER. R.C.Honey and E.M.T.Jones.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, 351-61 (May, 1960).

The techniques developed for designing periodically loaded travelling-wave parametric amplifiers using variable-reactance diodes are described in detail. An amplifier was built and tested with two different sets of eight diodes. The performance of the amplifier with each set of diodes agrees substantially with the theoretical predictions, the measured noise figures being about 1.2 dB higher than the theoretical values in each case. The gain of the second amplifier varied from a minimum of 6.7 dB to more than 13 dB over the band from 550 to 930 Mc/s, with a measured noise figure of 2.3 dB for wideband noise inputs in the middle of the band, corresponding to about 4.9 dB for single-frequency inputs.

MODULATION . DEMODULATION

621.376.22

6806 A HALL EFFECT MULTIPLIER FOR USE AT RADIO FREQUENCIES. E.Cohen.

Electronic Engng, Vol. 32, 558-9 (Sept., 1960).

A short discussion is given of the limitations of available low-frequency Hall-effect when used at radio frequencies. It is shown that the determining factor in high-frequency operation is carrier break-through caused by inductive pick-up in the Hall circuit (in the absence of a magnetic field) due to carrier current flowing in the plate. This may be minimized by certain circuit configurations and, in conjunction with plug-in broadband transformers lead to carrier break-through greater than 50 dB below maximum Hall signal.

621.376.4

6807 PHASE SENSITIVE DEMODULATION WITH INTERPOLATION. J.S.Johnston.

Electronic Engng, Vol. 32, 488-90 (Aug., 1960).

Describes a method of obtaining a very much better approximation to the envelope waveform of a modulated, low-frequency carrier, than is possible by conventional phase-sensitive demodulation. The method depends on some previous knowledge of the nominal shape of the waveform, and particular attention is given to the important sinusoidal case.

621.376.5 : 621.372.54

6808 OPTIMUM COMBINATION OF PULSE SHAPE AND FILTER TO PRODUCE A SIGNAL PEAK UPON A NOISE BACKGROUND. H.S.Heaps.

Proc. Instn Elect. Engrs, Monogr. 407 E, publ. Oct., 1960, 6pp. To be republished in Part C.

Concerns the generation of a signal pulse for transmission through a propagating medium and its subsequent detection as a single peak after it is received upon a noise background. It is supposed that the propagating medium behaves as a linear filter and that the noise background is independent of the signal. The pulse is conveniently described as consisting of a central portion attached to a leading edge and a trailing edge. It is found that for a given length of central portion there is an optimum combination of transmitted pulse shape and predetection filter. The results are compared with those arising from the use of certain non-optimum systems, and it is found that the optimum system leads to a significantly high signal/noise ratio. The results imply that for the range of parameters considered it is advantageous to transmit a succession of short pulses of a determined form rather than a single smooth pulse.

ELECTRONICS

SEMICONDUCTOR MATERIALS AND DEVICES
TRANSISTORS

621.382

6809 SEMICONDUCTOR MATERIALS FOR THERMOELECTRIC POWER GENERATION UP TO 700C.
F.D.Rosi, J.P.Dismukes and E.F.Hockings.
Elect. Engng, Vol. 79, No. 6, 450-9 (June, 1960).

An investigation into the thermoelectric properties of semiconductor materials to uncover the feasibility of power-generating efficiencies at temperatures from 25 to 700°C. Discussion is centred on general considerations of efficiency factors leading to materials selection and some preliminary results in the evaluation of compound semiconductors and their solid-solution alloys.

621.382 : 539.2 : 537.311

6810 SURFACE SPACE-CHARGE CALCULATIONS FOR SEMICONDUCTORS. D.R.Frankl.
J. appl. Phys., Vol. 31, No. 10, 1752-4 (Oct., 1960).

Approximation formulae for the surface excesses of carriers at large values of the reduced surface and bulk potentials are derived, and computed results are presented.

621.382 : 539.2 : 537.311

6811 FIELD EFFECT MEASUREMENTS IN A TRANSVERSE MAGNETIC FIELD. E.Aerts, S.Amelinckx and J.Vennik.
J. Electronics and Control, Vol. 7, No. 6, 497-504 (Dec., 1959).

Field effect measurements were carried out in a transverse magnetic field. A systematic study at different magnetic field-strengths revealed that the polarity of the space-charge layer could be inverted by a suitably chosen magnetic field. At the same time the behaviour of the magnetoresistance was studied. A qualitative interpretation of both phenomena is proposed.

621.382 : 539.2 : 537.311

6812 THE OSCILLISTOR - NEW TYPE OF SEMICONDUCTOR OSCILLATOR. R.D.Larrabee and M.C.Steele.
J. appl. Phys., Vol. 31, No. 9, 1519-23 (Sept., 1960).

A new magneto-oscillatory effect has been observed in the electron–hole plasma within a semiconductor. The plasma can be produced by such agents as contact injection and optical or thermal excitation of minority carriers. When the semiconductor specimen is subjected to an electric field (through suitable contacts) and a magnetic field, current oscillations can be detected across a series load resistance. This device has been termed the oscillistor to suggest a semiconductor oscillator. The experiments suggest that the oscillistor mechanism involves a magnetically induced interaction of the bulk plasma of electrons and holes with the exposed free surface areas of the specimen.

621.382

6813 P–N JUNCTIONS IN GALLIUM ARSENIDE.
D.N.Nasledov and B.V.Tsarenkov.
Fiz. tverdogo Tela, Sbornik [Supplement] I, 78-88 (1959). In Russian.

Reviews properties of gallium arsenide and describes methods of preparation of diffused p–n junctions and manufacture of diodes and photoresistors based on n-GaAs. Static current–voltage and photoelectric characteristics of the p–n junctions were obtained at room temperature. Analysis of the current–voltage characteristics showed that the results do not agree with Shockley's theory of 1949 and can only be partly explained by the Shockley–Noyce–Sah theory (Abstr. 324 of 1958). A.Tybulewicz

621.382.2 : 621.387.4 : 539.1.07

6814 THE USE OF SEMICONDUCTORS AS DETECTORS OF NUCLEAR RADIATIONS.
R.Bomal, L.Koch, Nguyen van Dong and C.Schneider.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 137-49. In French.

Gives the results of measurements of the pass band, sensitivity and s./n. ratio of germanium junction photodiodes and transistors. Pass-band and sensitivity both increase with the inverse voltage, while the s./n. ratio exhibits maxima. Experiments using junctions as direct detectors showed that energy resolution improved with increasing bias voltage. For β-and γ-ray measurements, a scintillator was interposed between the source and the crystal to prevent decrease of sensitivity by high-energy particles. The method is at present of interest only for dosemeters. Experiments were also made in the detection of thermal neutrons, in which the counting efficiency was low, but may be improved by boron enrichment, and in the conversion of nuclear to electrical energy. If a load resistance is connected across the junction, and if this is irradiated, a current flows. With a β-ray flux of 10 mc/cm^2, outputs of 10^{-4} to 10^{-5} W were obtained. W.G.Stripp

621.382.2 : 539.2 : 537.311

6815 AVALANCHE BREAKDOWN IN A DIODE WITH A LIMITED SPACE-CHARGE LAYER. Z.S.Gribnikov.
Fiz. tverdogo Tela, Vol. 2, No. 5, 854-6 (May, 1960). In Russian.

Discusses lowering of the breakdown voltage in diodes with a small distance between the rectifying and "ohmic" contacts using the assumption that the ionization coefficient of carriers depends strongly on the field. A.Tybulewicz

621.382.23

6816 THERMAL CHARACTERISTICS OF SILICON DIODES. II.
J.R.Madigan.
Electronic Industr., Vol. 19, No. 1, 83-7 (Jan., 1960).

A reference unit with relatively temperature-insensitive properties can be obtained by series combination of forward- and reverse-biased diodes. Because the temperature coefficient is a sensitive function of current it is required that the current through the device is kept reasonably constant. Utilizing the temperature-dependence of the forward voltage a method of measuring the thermal resistance is described. Reference-unit stability and thermal time-constants are briefly discussed. Four references and ten graphs are added. P.Szekely

621.382.23

6817 USING THE TUNNEL DIODE.
E.Gottlieb.
Electronic Industr., Vol. 19, No. 3, 110-13 (March, 1960).

Gives a simple discussion of the principles to be followed in displaying the true characteristics experimentally without distortion due to oscillation of the test circuits, and on the other hand of the use of the negative resistance to obtain gain. F.F.Roberts

621.382.232 : 539.2 : 537.311

6818 FAST NEUTRON BOMBARDMENT OF GERMANIUM AND SILICON ESAKI DIODES. J.W.Easley and R.R.Blair.
J. appl. Phys., Vol. 31, No. 10, 1772-4 (Oct., 1960).

The fast neutron irradiation behaviour of germanium and silicon Esaki diodes has been experimentally examined. The dominant change produced is an increase in the "excess" current which is proportional to integrated neutron flux. The observed increase in the vicinity of the current minimum is approximately 2.6×10^{-15} A/fast neutron and 1.1×10^{-14} A/fast neutron for germanium and silicon diodes respectively. Substantial changes result in the voltage–current characteristics of the diodes employed in the decade of exposure between 10^{16}-10^{17} fast neutrons/cm^2, for germanium diodes and between 10^{15}-10^{16} fast neutrons/cm^2 for silicon diodes. One kilomegacycle cavity oscillators employing germanium diodes exhibit a marked reduction in power output in the decade of exposure between 10^{16}-10^{17} fast neutrons/cm^2. The magnitude of the decrease is in approximate agreement with the observed bombardment reduction of diode negative conductance.

621.382.232 : 621.375.4

6819 TUNNEL DIODE AS AN INTERSTAGE GAIN DEVICE.
L.A.LoSasso.
Proc. Inst. Radio Engrs, Vol. 48, No. 4, 793-4 (April, 1960).

A note suggesting the use of tunnel diodes as impedance transformers between common-base transistor amplifying stages. A stage gain of 20 dB is claimed for an embodiment having a bandwidth of 300 kc/s at 10 Mc/s, these figures being limited by the high shunt capacitance of the diodes used. T.H.D.Attewell

621.382.232

6820 GALLIUM ARSENIDE TUNNEL DIODES.
N.Holonyak, Jr and I.A.Lesk.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1405-9 (Aug., 1960).

The fabrication and properties of GaAs tunnel-diodes are described. The material preparation is discussed; devices are described which have been fabricated consistently with peak-to-valley current ratios >15 : 1, with voltage swings in the range

from 0.9 to 1.2, and with current densities from 2 kA/cm^2 to over 10^4 A/cm^2 (and with correspondingly low capacitances, e.g., capacitances as low as 0.2 $\mu\mu$F/mA and g/C figures of merit as high as 5×10^{10} sec^{-1}). The temperature behaviour of typical units is presented. Applications particularly well suited to GaAs units are mentioned.

621.382.232

6821 SHOT NOISE IN TUNNEL DIODE AMPLIFIERS. J.J.Tiemann.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1418-23 (Aug., 1960).

The contributions of Johnson noise and shot noise to the noise in a tunnel diode are analysed according to a simple theoretical model. The current stream flowing across the junction in one direction is assumed to be uncorrelated with that flowing across the junction in the opposite direction, and both current streams are assumed to produce full shot noise. A simple parabolic band structure is also assumed. There is qualitative, but not quantitative, agreement between the predictions of this model and the experiment. On the basis of some simplifying assumptions (which are consistent with the experiment), the noise figure of a tunnel diode amplifier is calculated. A simple graphical method of determining the approximate noise figure of a diode from its current voltage characteristic is presented. It is found that the noise figure has a broad minimum centred about a point slightly higher in bias than the bias value for maximum negative conductance.

621.382.232

6822 ESAKI OR TUNNEL DIODES. I-II. W.W.Gärtner.

Semiconductor Prod., Vol. 3, No. 5, 31-8 (May); No. 6, 36-8 (June, 1960).

This survey discusses the physical effects which produce the electrical characteristics of the tunnel diode, outlines design and construction of the devices, describes the electrical properties realized thus far, gives diagrams and design equations for d.c. bias, oscillator, amplifier and switching circuits, and analyses the potentialities of the device.

621.382.233 : 621.374.32

6823 GERMANIUM p-n-p-n SWITCHES. S.Denda.

Direct Curr., Vol. 4, No. 8, 232-5 (March, 1960).

Describes, and illustrates with a micro-section and oscillograms, the construction and operation of alloy-diffused devices. The injection efficiency of one junction at low currents is made low by scratching the semiconductor surface across the edge of the junction. The opposite alloyed junctions are offset so that the transmission factor across the thicker intermediate layer is increased at higher currents by the drift field due to the current. Two different modes of operation of the third electrode are discussed. F.F.Roberts

621.382.233 : 539.2 : 537.311

6824 TURN-ON TRANSIENT OF P–N–P–N TRIODE. T.Misawa.

J. Electronics and Control, Vol. 7, No. 6, 523-33 (Dec., 1959).

The turn-on transient of the p–n–p–n switch is analysed with simplifying assumptions. Experiments on the silicon p–n–p–n power triode show that two mechanisms determine the current waveform during the transient. Before the centre junction becomes forward biased (switches on), the current increases nearly (or faster than) exponentially. After switch-on, the p–n–p–n switch behaves as an inductive impedance and the increase rate of current decreases. This is ascribed to the gradual modulation of conductivity of a base region of high resistance. Analytical expression is derived for the relation between base current and delay time when the step current is applied to the base.

621.382.333 : 539.2 : 537.311

6825 ON THE DETERMINATION OF THE MINORITY CARRIER LIFETIME IN THE BASE REGION OF TRANSISTORS. M.B.Das and A.R.Boothroyd.

J. Electronics and Control, Vol. 7, No. 6, 534-9 (Dec., 1959).

A method of determining the lifetime of minority carriers in the base region of a uniform base transistor is presented. This involves measurement of the base-width modulation parameters and the base transport time, taking into account effects of all extrinsic properties of the transistor. The technique of measurement also leads to a simple method of determining the extrinsic base resistance and collector capacitance.

621.382.333

6826 ON THE DETERMINATION OF THE EXTRINSIC EQUIVALENT CIRCUIT PARAMETERS OF DRIFT TRANSISTORS. M.B.Das.

J. Electronics and Control, Vol. 8, No. 5, 351-63 (May, 1960).

Methods of determining the "effective" extrinsic base resistance and collector capacitance of alloy-junction and diffused-type of graded-base transistors are presented. These methods involve measurements of the common-base short-circuit output and input admittances at frequencies much less than the cut-off frequency of the transistor and are particularly suitable for devices where the base contact is made very close to the emitter. Results obtained by these methods and also by previously described methods of determining the extrinsic base resistance are compared for several types of graded base transistor. The validity and accuracy of the approximate equivalent circuit representation of the extrinsic base properties by an "effective" constant resistance are discussed.

621.382.333.33

6827 APPROXIMATE EXPRESSIONS FOR THE ALPHA CUT-OFF FREQUENCY OF THE DRIFT TRANSISTOR. R.E.Aitchison.

Proc. Instn Radio Engrs Australia, Vol. 21, No. 6, 413-14 (June, 1960).

PHOTOELECTRIC DEVICES

621.383 : 621.375.4 : 536.3

DETECTIVITY AND PREAMPLIFIER CONSIDERATIONS FOR INDIUM ANTIMONIDE PHOTOVOLTAIC DETECTORS. See Abstr. 6238

621.383.2

6828 FINDING SPECTRAL RESPONSE OF ELECTRO-OPTICAL MATERIALS. S.J.Roth.

Electronics, Vol. 33, No. 14, 66-7 (April 1, 1960).

A generalized description of a conventional system for determining the spectral response of photosensitive devices, the emission of phosphors, and the transmission of filters. It uses a double monochromator and automatically records the spectra, while calibration of the phototube detectors is done by recording the response of a sensitive high-speed thermocouple to the monochromatic light beam chopped at 13 c/s. S.T.Henderson

621.383.2 : 539.2 : 535.37

6829 THE PREPARATION OF ELECTROLUMINESCENT PANELS. G.Siddall.

Vacuum, Vol. 7-8, 61-71 (1957-58: publ. April, 1959).

Gives complete details of the manufacture of electroluminescent light sources, using vacuum deposited films for the conducting electrodes. Commencing with a glass base, which is made electrically conductive by sputtering a transparent cadmium oxide film, the phosphor is mixed with a resin-based lacquer and sprayed on the semiconducting oxide film. This is followed by a second layer of insulating material upon which the top electrode of aluminium may be deposited by evaporation in vacuum. Upon applying an alternating field between the two conducting electrodes, the phosphor emits light through the transparent oxide film. Three power supplies have been made to supply alternating current at suitable voltage and frequency, and full details are given.

621.383.2.032.35

6830 A REVIEW OF PANEL-TYPE DISPLAY DEVICES. J.J.Josephs.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1380-95 (Aug., 1960).

These devices are thin sheets which can display luminescent information. The displays are grouped as: evacuated, solid, gas, liquid and mechanical. The evacuated types include thin cathode-ray tubes and image intensifiers. The solid-type displays employ the electroluminescent panel in conjunction with an xy matrix of electrodes. Recent progress in panels of the above type with memory is included as well as a brief discussion of solid-state image-intensifiers. Descriptions of proposed gaseous displays as well as of liquid and mechanical displays are given. Switching circuits are briefly discussed. Actual as well as possible applications of these devices are listed. 67 references.

621.383.27 : 537.533

6831 STUDY AND DESIGN OF A PHOTOMULTIPLIER FOR THE NANOSECOND REGION. G.Pietri.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960). p. 57-65. In French.

The photomultiplier, (L.E.P. type 204) is designed to give a linear output at the anode up to more than 300mA. The current gain is between 10^3 and 10^5 and is obtained by the use of 14 dynodes with stage voltages up to 400 and a carefully designed electron-optical system between the photo-cathode and the first dynode. The dynode structure is designed to have trajectory-compensating and focussing effects, so that asynchronism is reduced to a minimum and rise times between 2 and 3×10^{-9} sec are obtained.

W.G.Stripp

621.383.27 : 537.533

6832 MEASUREMENT OF THE SPEED OF RESPONSE OF THE L.E.P. TYPE 204 PHOTOMULTIPLIER.
Y.Koechlin.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 67-72. In French.

See also Abstr. 6831 of 1960. Pulse shapes were investigated, using an oscillating ball light source and a high-speed oscilloscope. The expected rise times of about 2×10^{-9} sec were confirmed.

W.G.Stripp

621.383.27 : 537.533

6833 CONTRIBUTION TO THE STUDY OF PHOTOMULTIPLIER CHARACTERISTICS. R.Chery and A.Perrin.
Nuclear Electronics Conference, Paris, 1958. Vol.I. (see Abstr. 4975 of 1960) p. 73-8. In French.

The photomultiplier studied was the French 53AVP. The first experiment described was designed to study the statistical pulse spectrum for single photoelectrons. The light source was weak enough to ensure time resolution of the photons, and background noise was reduced by cooling the photomultiplier. It was found that larger amplitude pulses were produced as the total voltage was increased from 1700 to 1750 V. This is attributed to a reduction of the variation of stage gain with increasing voltage. Cathode homogeneity was measured by means of a disk with a spiral of 1 mm holes; inhomogeneities of 10 to 25% were found. Variations of transit time were measured as a function of distance from the centre of the photocathode, and amounted to 3-4mμs. W.G.Stripp

621.383.8

6834 TEMPERATURE CONTROL OF SILICON SOLAR CELLS IN SPACE ENVIRONMENT. W.Luft and H.Nash.
Semiconductor Prod., Vol. 3, No. 6, 39-43 (June, 1960).

The performance of silicon cells in converting radiant energy into electrical energy is dependent on the cell temperature. Most affected by temperature is the optimum power transfer characteristic, which has a temperature coefficient of −0.6% per deg. C. In a space environment the temperature of a solar collector is determined by the radiation equilibrium and hence by the optical characteristics of its surface. Conventional silicon solar cells have optical characteristics which produce higher surface temperatures than desired for good operating efficiency. Optical coatings have been developed which notably reduce the temperature, with corresponding increase in power output.

PARTICLE ACCELERATORS

621.384.612 : 537.54

6835 SOME FEATURES OF REGENERATIVE DEFLECTION AND THEIR APPLICATION TO THE HARVARD SYNCHROCYCLOTRON. G.Calame, P.F.Cooper, Jr, S.Engelsberg, G.L.Gerstein, A.M.Koehler, A.Kuckes, J.W.Meadows, K.Strauch and R.Wilson.
Nuclear Instrum., Vol. 1, No. 4, 169-82 (July, 1957).

The regenerative deflector system applied to the Harvard synchrocyclotron is described. The theory of LeCouteur has been extended to include the initial radial oscillations, and it is shown, both theoretically and experimentally, that only partial monochromatization of the beam occurs during regeneration. However, it is possible to internally limit the energy width of the regenerated beam at the expense of intensity. The theory is in good accord with experiment. The application of these results to the production of an intense external proton beam and more monoenergetic neutron and polarized proton beams is described.

621.384.621 : 537.54

6836 COMPACT 1.5 MeV ELECTROSTATIC ACCELERATOR. L.I.Pivovar, V.M.Tubaev and M.T.Novikov.
Zh. tekh. Fiz., Vol. 30, No. 1, 74-81 (Jan., 1960). In Russian.
English translation in: Soviet Physics—Technical Physics (New York), Vol. 5, No. 1, 67-73 (July, 1960).

A description is given of the design of accelerating tubes and of an electrostatic accelerator, which operate in compressed gas; operational tests are also described. The accelerator is located in a tank 1400 mm high and 650 mm in diameter. The accelerator produced hydrogen ions with an energy of 1.55 MeV, and the potential gradient along the accelerating tube is approximately 2 MV/m.

ELECTRON TUBES

621.385

6837 THE SPECTRUM OF FLICKER NOISE. A.N.Malakhov.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 54-62 (Jan., 1959). In Russian.

Reviews the basic experimental and theoretical results relating to flicker noise and discusses the fundamental difficulties of flicker noise theory. The possibility of overcoming these difficulties by assuming flicker noise to be non-stationary in nature is examined. Some possible causes of flicker noise in vacuum tubes, composition resistors and semiconductors are suggested. R.C.Glass

621.385.1

6838 WHAT'S NEW IN ELECTRON TUBES.
Electronics, Vol. 33, No. 18, 54-90 (April 29, 1960).

A series of articles devoted to a survey of modern developments in the field of receiving, power and gas-filled valves, travelling wave and crossed-field microwave valves, cathode-ray tubes and storage, counting, television and photo-tubes. R.C.Glass

621.385.1

6839 THE POTENTIAL DISTRIBUTION AND THERMIONIC CURRENT BETWEEN PARALLEL PLANE EMITTERS. F.H.Reynolds.
Proc. Instn Elect. Engrs, Monogr. 408 E, publ. Oct., 1960, 11 pp. To be republished in Part C.

A thermionic system formed of two parallel plane emitters facing each other is analysed. By means of Tables, the distribution of potential between the emitters and the net space-charge-limited current which flows between them can be obtained for any emitter potential, temperature and saturation current density. The results are applied to practical problems including the thermo-electric and conductivity characteristics of oxide cathodes.

621.385.1

6840 RELIABILITY OF ELECTRON TUBES IN PRACTICAL USE. W.Chladek.
J.E.L. Nachr., Vol. 7, No. 4, 189-94 (1959). In German.

Results of life tests under laboratory conditions are analysed and their consequences in the designs of apparatus discussed. Detailed examples of reliability calculations are given.

A.H.W.Beck

621.385.6

6841 SOME PROPERTIES OF THREE COUPLED WAVES. L.Solymar.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 284-91 (May, 1960).

Deals with the problem of three waves, 1, 2, and 3, in which waves 2 and 3 are coupled to wave 1 but not to each other. The general solution for the amplitude of the waves is given in closed form. It is shown that for certain values of the parameters growing waves can exist. Numerical solutions for the location of the boundaries of the growing wave regions are plotted. It is shown furthermore that under certain conditions the power can be completely transferred from wave 1 to waves 2 and 3. Examples on travelling-wave tubes, waveguide couplers, and backward-wave oscillators illustrate the applicability of the theory.

621.385.6

6842 MICROWAVE VALVES: A SURVEY OF EVOLUTION, PRINCIPLES OF OPERATION AND BASIC CHARACTERISTICS. C.H.Dix and W.E.Willshaw.
J. Brit. Instn Radio Engrs, Vol. 20, No. 8, 577-609 (Aug., 1960).

After a brief description of the evolution of the different classes of microwave valves, the principal modern types are discussed under the headings of their mode of operation: "O" type interaction, "M" type (crossed field), variable reactance amplifiers; and the maser. A brief survey is given of the performances obtained. 89 references.

621.385.6

6843 MICROWAVE TUBES - AN INTRODUCTORY REVIEW WITH BIBLIOGRAPHY. A.F.Harvey.
Proc. Instn Elect. Engrs, Monogr. 343, publ. Sept., 1959 (Vol. 107C, 29-59, 59, 1960).

Reviews the various types of electron vacuum tubes employed for amplification and generation at microwave frequencies. Emphasis is placed on principles of operation and on tubes recently developed to give high power output, oscillations at the highest frequencies and low noise factors. The treatment is restricted to conventional tubes in which the output energy is derived from the d.c. input. The subject is interpreted in terms of published work, the text being closely associated with a bibliography which is complete up to the Microwave Valve Convention of May, 1958. After a general introduction, the first part discusses grid-controlled tubes. It is then shown how the interaction of space-charge waves with resonant cavities and slow-wave circuits results in the various forms of drift-space and growing-wave tubes. The second part deals with crossed-field interaction in planar and circular geometry and includes an examination of the magnetron. An account is given of novel methods of generation of submillimetre waves and the usual sources of electrons are described. The third part analyses noise phenomena in oscillators and amplifiers.

621.385.62 : 537.533

6844 MAGNETIC SYSTEM WITH AN INHOMOGENEOUS FIELD FOR THE EXPERIMENTAL INVESTIGATION OF ELECTRON TUBES. A.Ya.Sochnev.
Zh. tekh. Fiz., Vol. 30, No. 8, 933-7 (Aug., 1960). In Russian.

As a useful tool in the investigating of the sensitivity of electron tubes employing magnetic fields to inhomogeneities in these, a magnetic system providing deliberate inhomogeneities is required. Calculations are given for the construction of systems possessing large inhomogeneities of given form. In particular a system giving a parabolically changing axial magnetic field is designed.

A.E.I.Research Laboratory

621.385.623.5

6845 NOISE FIGURES OF REFLEX KLYSTRON AMPLIFIERS. K.Ishii.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 291-4 (May, 1960).

The noise figure of the 2K25 reflex klystron was investigated. This noise figure depends on operating frequency, electronic impedance, circuit impedance, and operating electronic mode. Experimental results show that a noise figure of 5 dB is possible under particularly carefully adjusted conditions. In order to obtain the low-noise figure, careful electronic tuning and the impedance adjustments are particularly important. Generally, relatively low noise figures were obtained when the electronic tuning was good. Noise figures of cascaded reflex klystron amplifiers were also investigated experimentally. Noise figures of the cascaded amplifier were generally higher than that of the single stage amplifier, but still low enough to use this reflex klystron amplifiers as a preamplifier of a microwave receiver to increase the sensitivity of the receiving system.

621.385.623.5

6846 TRANSISTORIZED LOCK-IN FOR KLYSTRON AUTOMATIC FREQUENCY CONTROL.
A.J.George and D.T.Teaney.
Rev. sci. Instrum., Vol. 31, No. 9, 997-8 (Sept., 1960).

621.385.624

6847 TRANSISTORIZED FREQUENCY STABILISATION FOR REFLEX KLYSTRONS USED IN MAGNETIC RESONANCE. P.Jung.
J. sci. Instrum., Vol. 37, No. 10, 372-4 (Oct., 1960).

The description of a fully transistorized frequency stabilizer for reflex klystrons is given. This is suitable for magnetic-resonance experiments and other microwave applications, where frequency stability is essential. In a typical case (klystron type 2K25, cavity Q = 3000) the effect of ripple and drift of the power supply is reduced by a factor of 1000.

621.385.632

6848 IMPROVEMENTS IN A C.W. POWER TRAVELLING-WAVE TUBE. M.O.Bryant, J.F.Gittins and F.Wray.
J. Electronics and Control, Vol. 7, No. 6, 505-17 (Dec., 1959).

Describes a number of improvements in a "clover leaf" c.w. travelling-wave amplifier for X-band. The alterations, which include the introduction of a new electron gun, re-designed waveguide transitions and a light-weight electromagnet, have converted an experimental tube into a practical c.w. transmitter. An output power of greater than 1 kW can now be obtained over a tuning range of 5%, with high level gain greater than 10 dB. The factors influencing the changes in design are discussed and detailed performance characteristics quoted.

621.385.632.1 : 537.533

6849 ELECTRON SHEET BEAM FOCUSING WITH TAPE LADDER LINES. W.E.Waters.
J. appl. Phys., Vol. 31, No. 10, 1814-20 (Oct., 1960).

The d.c. properties of a periodic focusing system consisting of a parallel pair of ladder lines, together with focusing plates parallel to the lines, are calculated. First, Laplace's equation is solved in an approximate way; following this, the paraxial-ray equation for an electron sheet beam, injected into the system halfway between the ladder lines, is solved for perveance, plasma frequency, beam stiffness, and average beam potential. Finally, a numerical example is presented and discussed.

621.385.64

6850 GENERAL STEADY-STATE THEORY OF LINEAR MAGNETRONS. I. P.A.Lindsay.
J. Electronics and Control, Vol. 8, No. 3, 177-206 (March, 1960).

Space charge and the Maxwellian velocity distribution of the emitted electrons are taken into account, but the collisions between individual electrons are neglected. Pt I explains the mathematical basis of the calculations and gives expressions for the volume density of the electrons and for the two components of the electron current density. A detailed analysis of these expressions will be provided in Pt II. No calculations of the actual potential distribution are given. However, for a certain range of such distributions, the following general conclusions concerning the steady-state theory of a linear magnetron can be drawn. (1) Brillouin's single-stream flow is not possible when the emission velocities of the electrons are taken into account. (2) In a well "cut-off" magnetron the tangential component of the current density may be several hundred times larger than the perpendicular component. Thus, even slight imperfections in the geometry of the valve may cause large contributions to the anode current from those electrons which nominally should only graze the anode. (3) When the tangential component of the current density is relatively high, the conditions inside the magnetron may approach those given by the single-stream flow, although now the perpendicular component of the current density is still present, even if it is rather small. This resolves the difficulty of establishing a pure single-stream flow. (4) The appearance of a potential minimum between the electrodes does not necessarily limit the amount of the current drawn to the anode.

621.385.832

6851 ELECTROSTATIC DEFLECTION PLATES FOR CATHODE-RAY TUBES. I. DESIGN OF SINGLE-BEND DEFLECTION PLATES WITH PARALLEL ENTRANCE SECTIONS. II. DEFLECTION DEFOCUSING DISTORTION OF SINGLE-BEND DEFLECTION PLATES WITH PARALLEL ENTRANCE SECTIONS. L.Frenkel.
J. Res. Nat. Bur. Stand., Vol. 64C, No. 2, 103-10, 110-13 (April-June, 1960).

A plate design system is offered which allows rapid and accurate determination of mechanical plate parameters to achieve given electrical plate characteristics. The design is suitable for single-bend plates with parallel entrance sections. The design curves were calculated under the conventional assumptions of small deflection theory, but corrections for the entrance and exit fields are included. The method of calculating the curves and corrections is indicated in an appendix. Section II deals with deflection defocusing of such plates, a convenient formula for calculating the defocusing distortions of single-bend deflection plates is derived and compared with experiment. This type of distortion is proportional to the square

of the deflection angle and is shown to be sensitive to plate design. In general, long deflection plates give lower distortions while the most "economical" plates yield larger distortions. Post deflection is shown to lead to increased distortions.

621.385.832 : 539.2 : 535.37

6852 INFLUENCE OF BINDERS UPON THE SURFACE BRIGHTNESS OF CATHODE-RAY TUBE SCREENS. III. I.Hangos, H.Toperczer and G.Pozsgay.
Acta tech. Hungar., Vol. 29, No. 1-2, 47-55 (1960).

A study was made of screens of Zn_2SiO_4:Mn and ZnS:Ag, using Sr^{90} to estimate the Sr content of the binder layer, and the attenuation of cathode rays to estimate the layer thickness. Screen brightness depends on these variables, which themselves depend on the concentrations of binder (K silicate) and coagulator (Sr nitrate). For earlier work see Abstr. 3170 and 5500 of 1958. S.T.Henderson

621.385.833

6853 DEFLECTION FOCUSING OF ELECTRON MICROSCOPES. R.S.Mackay and N.T.Seaton.
I.R.E. Trans Med. Electronics, Vol. ME-7, No. 2, 87-94 (April, 1960).

An image in an electron microscope is made to move in response to manipulation of a switch if the image is slightly out of focus. Because of the sensitivity of the eye to motion, even low-contrast or dim images can thus be focused very accurately by noting lack of motion. This method is helpful in all cases, but with certain specimen types or with a biased electron gun it is essential. Construction information is given for a magnetic beam-deflection unit that has performed well in regular use for over ten years. The electron optics of certain corrections are discussed briefly.

621.385.833 : 537.533

6854 THE CALCULATION OF ELECTROSTATIC ELECTRON-GUN PERFORMANCE. M.R.Barber and K.F.Sanders.
J. Electronics and Control, Vol. 7, No. 6, 465-81 (Dec., 1959).

An automatic electron trajectory tracer was used to analyse four different high current density electron guns operated electrostatically.

621.385.833 : 537.533

6855 TRIODE PIERCE GUNS. B.Meltzer.
J. Electronics and Control, Vol. 7, No. 6, 491-6 (Dec., 1959).

The range of application of high-perveance Pierce guns may be increased by converting them to triode and multi-triode systems. A method is given and its applications for valve design in general are pointed out.

621.385.833 : 537.533

6856 A STUDY OF APERTURE-TYPE ELECTRON LENSES WITH SPACE CHARGE. L.A.Harris.
J. Electronics and Control, Vol. 8, No. 4, 241-65 (April, 1960).

The electron-optical action of round and slit apertures in the anodes of parallel-plane diodes is investigated. The influence of aperture size on the space-charge-limited current is calculated and included in the determination of paraxial electron trajectories. The results computed by machine are expressed in terms of an effective thin lens whose position and strength are modified from the usual values. The effective focal length is somewhat shorter than predicted by simple lens formulae while the position of the equivalent lens moves farther from the cathode as the aperture size increases. Experiments on devices similar to that analysed give limited confirmation of the theory. They also demonstrate several effects of practical significance which are not treated theoretically.

621.385.833 : 537.533

6857 BALANCED ACCELERATION AND DEFLECTION ELECTROSTATIC FOCUSING. P.A.Sturrock.
J. Electronics and Control, Vol. 8, No. 4, 267-72 (April, 1960).

Periodic focusing systems normally have the following property: as the strength of the focusing field is increased from zero, the system is initially stable but subsequently passes through alternate bands of stability and instability, of which the former are normally the narrower. In consequence, operation of a given system must usually be restricted to the first band. A suitable combination of acceleration focusing and deflection focusing leads to a model for a periodic electrostatic focusing system which is free from instabilities. Convenient electrode structures are shown which will approximate the required field; the resulting system should have only narrow bands of instability. Such structures are similar to the slalom configuration with the important difference that the beam travels on one side only of the central electrodes. This scheme also has the following characteristics which should make it suitable for incorporation in a tape-helix travelling-wave tube: the beam velocity varies in such a way that electrons spend most time between the central electrodes, and the beam thickness varies in such a way that the beam is thinnest where it passes the central electrodes.

621.385.833 : 537.533

6858 NON-LINEAR BEHAVIOUR OF A MODULATED ELECTRON BEAM IN THE PRESENCE OF A VELOCITY DISTRIBUTION. S.V.Yadavalli.
J. Electronics and Control, Vol. 8, No. 5, 365-75 (May, 1960).

A procedure based on the Boltzmann equation is given for evaluating the harmonic currents in an electron beam in the presence of a velocity distribution. Employing this method, the second harmonic current in a drifting (initially velocity modulated) beam possessing a velocity distribution is evaluated.

621.385.833 : 537.534

6859 A PARAXIAL FORMULATION OF THE EQUATIONS FOR SPACE-CHARGE FLOW IN A MAGNETIC FIELD. P.T.Kirstein.
J. Electronics and Control, Vol. 8, No. 3, 207-25 (March, 1960).

The equations for irrotational, axially symmetric, laminar, space-charge flow are set up in a paraxial manner. To this approximation, the flow is specified by the magnetic field configuration, one trajectory, the potential along this trajectory, and the variation of beam thickness. Any three of these quantities may, within certain limits, be specified arbitarily, and the fourth then computed by the formulae given. The method is directly applicable to flows in which the cathode is conical, and either the flow lines do not cut magnetic flux lines, or the magnetic field is tangential at the cathode. Numerical results are given for a beam from a cylindrical cathode, and extensions of the methods are discussed.

621.385.833

6860 AN ELECTROSTATIC LENS ANALYSER OF ELECTRON VELOCITIES WITH A HIGH RESOLVING POWER. A.N.Kabanov and V.I.Milyutin.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 109-19 (Jan., 1959). In Russian.

The properties of a single cylindrical three-electrode electrostatic lens operating as a velocity analyser are described. The results of an experimental investigation of the dependence of the dispersion and resolving power of the analyser on the geometrical parameters and the electron velocities etc. are given. An analyser having a resolving power of 60 000 : 1 is described. R.C.Glass

621.385.833

6861 SOME APPLICATIONS OF THE ELECTROSTATIC ELECTRON VELOCITY ANALYSER. A.N.Kabanov and V.I Milyutin.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 321-9 (Feb., 1959). In Russian.

Describes measurements of energy loss of electrons passing through thin films of various materials using an electrostatic analyser (see preceding abstract). The results are compared with those obtained by other workers. A method of using the analyser for investigating fluctuations in high-voltage supplies is considered and results obtained are illustrated. [English summary: PB 141106T-13, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.385.833

6862 DEFOCUSING OF A PLANE-CYCLOIDAL ELECTRON BEAM DUE TO THE ACTION OF SPACE CHARGE. K.Ya.Luzhdvoi.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 120-5 (Jan., 1959). In Russian.

The motion of an electron beam in crossed electric and magnetic fields is considered and defocusing of the beam in the magnetic field direction due to space charge is examined. The conditions under which it is necessary to compensate the space charge effect to avoid serious defocussing are derived.

R.C.Glass

621.385.833

6863 ELECTRON BEAM FOCUSING WITH PERIODIC MAGNET STRUCTURES. Ho Kuo-Chu.

Scientia Sinica, Vol. 8, No. 12, 1471-89 (Dec., 1959).

Optimum focusing conditions and stability criteria are obtained from a second-order perturbation solution of the paraxial ray equation. The space-charge term is taken into account, and the cases of zero, partial and full magnetic shielding of the cathode are treated. Results are found for both sinusoidal and non-sinusoidal magnetic fields. Good agreement is found with the experimental observations of Mendel et al. (Abstr. 3811 of 1954) on stop bands, and comparison is made with Harker's analogue computation (Abstr. 2368 of 1956). A stability chart is given showing how the stop bands are shifted due to space-charge and flux at the cathode.

B.Meltzer

621.386.1 : 539.12

6864 EXPERIMENTS WITH A LOW INDUCTANCE HIGH VACUUM X-RAY FLASH TUBE SET.

P.Ohlin and S.Hindel.

Ark. Fys., Vol. 17, Paper 9, 157-61 (1960).

A new type of low-inductance X-ray flash tube is described. A low-inductance capacitor was used and the intensity of the X-rays was studied for different circuit inductances. A new phenomenon was observed; the intensity was shown to depend strongly on the circuit inductance.

GAS DISCHARGES
GAS-DISCHARGE TUBES

621.387.4 : 539.1.07

6865 A CERENKOV GAS COUNTER. M.Beneventano.

Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 103-6. In French.

The counter was designed to distinguish electrons from ions in electronsynchrotron experiments, and an efficiency of 100% was aimed at. Measurements of efficiency with μ mesons showed that the desired efficiency was approached. W.G.Stripp

621.387.4 : 539.1.07

6866 THE IONIZATION DETECTORS. U.Facchini.

Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 83-102.

A review of developments, including improvements in energy resolution and applications to geology and spectrometry, and a discussion of the basic process involved. 54 references are given. W.G.Stripp

621.387.4 : 621.382.2 : 539.1.07

THE USE OF SEMICONDUCTORS AS DETECTORS OF NUCLEAR RADIATIONS. See Abstr. 6814

621.387.424

6867 A SINGLE TRANSISTOR RADIATION SURVEY METER. M.Birnbaum.

Electronic Engng, Vol. 32, 428-9 (July, 1960).

A new type of portable radiation survey meter is described, employing a single transistor which provides the high voltage necessary for the G.M. counter and at the same time integrates the pulses to be measured.

621.387.424

6868 RECENT PROGRESS IN SCINTILLATION COUNTERS. Y.Koechlin.

Onde elect., Vol. 40, 235-42 (March, 1960). In French.

A bibliographical progress review in the field of scintillation counters both in France and abroad. Counters and the measuring apparatus used with them are discussed. Details of the performances of some scintillation counter assemblies are discussed and developments are described. 39 references.

621.387.464 : 539.2 : 535.37 : 539.1.07

6869 THE PROCESSES INVOLVED IN THE IMPROVEMENT OF PLASTIC SCINTILLATORS.

F.H.Brown, M.Furst and H.Kallman.

Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4175 of 1960) p. 15-26

The intensities of fluorescence in several materials were measured. The bulk solvents were polystyrene (PS) and polymethylmethacrylate (PMMA). The latter is structurally similar to liquid solvents known to be inefficient, and was used to investigate the possibility of using methods of enhancement successfully applied to liquids. PS was found to be a moderate solvent for energy transfer and, as in the case of liquid solvents, the use of an intermediate solvent such as naphthalene increases the efficiency. The processes involved are not yet fully understood. With PMMA, the maximum intensities were smaller but were increased to the same order as for PS by the use of naphthalene. The naphthalene concentration required (0.8 M) was several times higher than in PS. W.G.Stripp

621.387.464 : 539.1.07

6870 THE VARIATION OF PHOSPHOR DECAY TIME WITH SPECIFIC IONIZATION AND ITS APPLICATIONS. R.B.Owen.

Nuclear Electronics Conference, Paris, 1958. Vol. I, (see Abstr. 4975 of 1960) p. 27-35.

Certain organic phosphors give different shapes of scintillation pulse when excited by neutrons and γ-rays. Details are given of a circuit for measurement of the decay times. No difference in the fast components of decay were apparent, but the longer-lived components were found to be about twice as intense under neutron excitation as under γ-ray excitation. Applications in the simplification and improvement of neutron counters and spectrometers are discussed. W.G.Stripp

621.387.464 : 539.1.07

6871 NEW STUDIES OF THE PHYSICAL PROPERTIES OF ORGANIC AND MINERAL SCINTILLATORS.

L.Koch, Y.Koechlin, B.Mougin and L.Treguer.

Nuclear Electronics Conference, Paris, 1958. Vol. I, (see Abstr. 4975 of 1960) p. 53-6. In French.

Measurements were made to ascertain the influence of temperature on the photomultiplier and on the emission from the scintillator, and the effect of the mode of excitation on the light intensity and decay time. For a given filter, the photomultiplier temperature coefficient is constant between +20°C and −40°C. It is negative from u.v. to 5500 Å and positive above 5500 A. Between +4°C and +20°C, the temperature coefficient of light output is −1.2% for a ZnS:Ag scintillator and −0.5% for a plastic one, with α excitation. The ratio of emission for α and β particles of equal energy is 0.13 for anthracene and for plastic. Measured decay times are given for a number of materials. W.G.Stripp

621.387.464 : 539.12

6872 ENRICHED BORON SCINTILLATORS FOR SLOW NEUTRONS. H.Durand and P.Habert.

Nuclear Electronics Conference, Paris, 1958. Vol. I, (see Abstr. 4975 of 1960), p. 45-52. In French.

Glass made of $B_4O_7H_2$ ($2B_2O_3,H_2O$) was mixed with a powder of silver-activated zinc sulphate. Plain and crenellated Plexiglas supports were used. Measurements showed that efficiency was improved by a factor of 2 to 2.5 when the boron was enriched to 92% B^{10}. The crenellated support gave a further improvement. W.G.Stripp

621.387.464

6873 I.R.E. STANDARDS ON NUCLEAR TECHNIQUES: DEFINITIONS FOR THE SCINTILLATION COUNTER FIELD, 1960.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1449-53 (Aug., 1960).

ELECTRONIC EQUIPMENT

621.389

6874 THE ECONOMICS OF TEST PACKAGES. M.A.Dean.

I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 19-22 (June, 1960).

A method, "test packages", is proposed which, combined with adequate part qualification testing, yields valuable reliability data at a substantially lower cost. This method is particularly well suited for computers and other devices with repetitive assemblies. Furthermore, this method yields data based on actual circuit use of the parts.

621.389.049.75

6875 PRINTED CIRCUITS IN TELECOMMUNICATION. A.H.Baddeley.

Proc. Instn Radio Engrs Australia, Vol. 21, No. 5, 336-44 (May, 1960).

An outline is given of the various methods of producing printed wiring boards and then the etched foil method is described in detail.

MEDICAL ELECTRONICS

621.389

6876 WHAT IS A NERVE? R.S.Mackay.

I.R.E. Trans Med. Electronics, Vol. EM-7, No. 2, 94-7 (April, 1960).

Many of the observed properties of a nerve are summed up by noting that it appears to be a cascaded series of bistable elements. This implies an electrical negative resistance property which is observed to be tetrode-like, as opposed to arc-like. A time-dependent element in the regenerative feedback loop is involved in such things as anode-break stimulation. New nerve analogues are suggested by this view, and the common factor in previous ones is seen. Many excitable plant and animal cells show these properties. A brief general discussion of negative resistance is given. No new biological data is presented.

621.389 : 621.317.39

6877 INTRACARDIAC CATHETER TIP PIEZORESISTIVE PRESSURE GAUGE. M.Traite, W.Welkowitz and R.Downs.

Rev. sci. Instrum., Vol. 31, No. 9, 987-91 (Sept., 1960).

A pressure gauge is described that can be encased in a small-bore plastic catheter. The small size permits insertion directly into the heart. The unit uses a two-section piezoresistive element, operated as a cantilever. The sensitivity of the gauge is 0.16 mV V^{-1} per lb in^{-2}, and the frequency response is flat from 0 to 400 c/s.

621.389 : 621.317.39

6878 FAST, AUTOMATIC OCULAR PRESSURE MEASUREMENT BASED ON AN EXACT THEORY. R.S.Mackay and E.Marg.

I.R.E. Trans Med. Electronics, Vol. ME-7, No. 2, 61-7 (April, 1960).

Several tonometers are described which are simultaneously faster more accurate and more gentle than previous forms. They are easier to use and more convenient to read, and do not generally require anesthesia since their indication is recorded a fraction of a second after they contact the eye. Their principle is such that they can be used while covered with a sterilizable rubber film, thus minimizing risk of infection and clogging of the instrument. New systems of tonography are also described. The factors which allow readings by a component insensitive to variations in corneal curvature, bending forces, tissue tension and surface tension of tears suggest other biological applications such as blood pressure monitoring through intact vessels. A discussion of a number of electronic motion and pressure transducers is included.

621.389 : 621.317.39

6879 FOREIGN BODY AND KIDNEY STONE LOCALIZER. R.S.Mackay.

I.R.E. Trans Med. Electronics, Vol. ME-7, No. 2, 74-6 (April, 1960).

Various probes are described which amplify the sound of contact with any hard object in the body and thus signify its presence. One of the most useful forms consists of a sound transducer that clamps to the handle of any pair of forceps so that the surgeon knows when he is grasping a kidney stone or gall stone or other hard body. Also mentioned are active probes in which loading of a bilateral sound transducer, which is being driven by an external electrical circuit, causes an indication of contact as an apparent change in impedance. These forms seem especially sensitive when fitted into the end of a catheter.

TELECOMMUNICATION

621.391

6880 SYNTHESIS OF A COMMUNICATION NET. R.T.Chien.

I.B.M. J. Res. Developm., Vol. 4, No. 3, 311-20 (July, 1960).

A systematic method is given for the realisation of communication nets from their terminal capacity matrices. It is shown that this procedure results in a net whose total branch capacity is minimum for all nets satisfying the same terminal capacity matrix. It is also shown that when the terminal capacity matrix is indeterminate, then, for a given total branch capacity, the total terminal capacity is highest when all terminal capacities are made equal.

621.391

6881 ERROR CORRECTING CODES FOR CORRECTING BURSTS OF ERRORS. J.E.Meggitt.

I.B.M. J. Res. Developm., Vol. 4, No. 3, 329-34 (July, 1960).

It is observed that the codes of Abramson, Melas and others are essentially described by the characteristic equation that a certain matrix satisfies. Consequently it is found that transformations of these codes are possible provided that the characteristic equation is preserved. These transformations may then be exploited to produce codes that have a simple implementation and, in fact, a general method is indicated by which any code may be implemented when the characteristic equation is known.

621.391

6882 A CLASS OF DEFINITIONS OF "DURATION" (OR "UNCERTAINTY") AND THE ASSOCIATED UNCERTAINTY RELATIONS. M.Zakai.

Information and Control, Vol. 3, No. 2, 101-15 (June, 1960).

A new class of definitions for "time duration" and "bandwidth" (or "time uncertainty" and "frequency uncertainty"), in terms of norms of L^p spaces, is suggested. Some properties of the definitions and the associated uncertainty relations are derived. As examples of the application of these concepts, the problems of the approach of the probability distribution of shot noise towards the normal law, and the "beamwidth"–"aperture width" product in aerial theory, are considered.

621.391

6883 EFFECTIVE SAMPLING RATES FOR SIGNAL DETECTION; OR CAN THE GAUSSIAN MODEL BE SALVAGED? I.J.Good.

Information and Control, Vol. 3, No. 2, 116-40 (June, 1960).

The usual justification for talking about signal-to-noise ratio is in terms of a Gaussian model. This model can be treated either by means of information theory or by means of (earlier) methods of statistical inference. In either case the justification is often achieved by assuming that sampling is done at the Nyquist rate. This justification collapses if a record of finite duration is given, since the sampling theorem is then inapplicable. In fact the Gaussian model itself collapses since it leads to the absurd conclusion that an infinite amount of information can be obtained in a finite time. But the mathematical convenience of the Gaussian model cannot be lightly brushed aside. The intention of this paper is primarily to try to salvage the Gaussian model by assuming that there is an effective sampling rate that cannot be exceeded. This rate could be slower or faster than the Nyquist rate. If an inefficient, but pleasantly simple statistic (the "power statistic") is used, then there is less point in sampling faster than the Nyquist rate. Some material on spectral analysis and other matters is

collected together in appendices. Most of it could be found, explicitly or implicitly, in previous literature. The notion of interaction for weight of evidence, and its relationship to spectral analysis, is explained and does not seem to have been previously published.

621.391

6884 RADIO COMMUNICATION WITH ORTHOGONAL TIME FUNCTIONS. H.F.Harmuth.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 221-8 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Communication systems using orthogonal time functions for the transmission of information over radio links are characterized by the following properties: (1) the same amount of information may be transmitted per unit (p.u.) bandwidth and p.u. time with double-sideband modulation as with single-sideband modulation; (2) no phase lock between the carriers produced at the transmitter and at the receiver is necessary for detection by correlation. Hence, communication is less affected by rapid phase changes of the carrier than in systems requiring phase lock; (3) it is possible to operate under conditions of large Doppler shift without changing the frequency of the carrier produced at the receiver, provided the Doppler shift varies sufficiently slowly.

621.391

6885 ON THE TRANSMISSION OF INFORMATION BY ORTHOGONAL TIME FUNCTIONS. H.F.Harmuth.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 248-55 (1960) = Commun. and Electronics, No. 49 (July, 1960).

In a digital communication system each digit of a character may be represented by one function of an orthogal set of functions. This function is multiplied by +1 or −1 if binary digits are being used. All functions of the character are added and transmitted in parallel. This sum of functions is correlated in the receiver with each function of the orthogonal set and voltages of amplitude +1 or −1 are obtained. No interference between the digits of a character occurs if the signal is not band-limited. The crosstalk between the digits because of band limitation is computed for a system of orthogonal sine and cosine functions. The results show that a binary Teletype system transmitting 60 words per minute can be operated with about 25 c/s bandwidth. This figure decreases to the theoretical minimum of 15 c/s per channel for a multichannel system. Tests of experimental equipment show very good agreement with the theory.

TELEGRAPH AND TELEPHONE SYSTEMS

621.395

6886 THE DEVELOPMENT OF TELEPHONE AND TELEGRAPH SERVICES IN SWEDEN 1935-60. G.Svedhem.
Tele (Swedish Edition), 1960, No. 1, 42-52. In Swedish.

The average number of telephone receivers per 1000 inhabitants in Sweden rose from 100 in 1935 to 300 in 1960, 78% of all households now being subscribers. Swedish inland calls increased from 50 million/year in 1935 to 225 million/year in 1960; 60% of all traffic is now fully automatic. Curves are given showing the rise in traffic with foreign countries, from 400 000 to 1 800 000 calls over the period. Inland telegraph traffic rose from 2.5 million telegrams in 1935 to a peak of 5.1 million in 1957 dropping to 3.6 million in 1960, but foreign telegraph traffic did not show such a marked decline. Telex traffic, on the other hand, showed a steady increase, both for home and foreign traffic. Telex subscriptions beginning in Jan. 1946 rose to 1750 in 1960 and metered charge units rose from ½ to 10 million over the same period.
G.N.J.Beck

621.395.12

6887 EMERGENCY TELEPHONES FOR THE LONDON–YORKSHIRE MOTORWAY. G.Turner.
Post Off. elect. Engrs' J., Vol. 52, Pt 4, 243-5 (Jan., 1960).

The first section of the London–Yorkshire motorway to be constructed, between London and Birmingham, has been provided with emergency telephones at intervals of approximately one mile. The signalling system used is described.

621.395.2

6888 AUTOMATIZATION OF INTERNATIONAL TELEPHONE TRAFFIC. B.Bjurel.
Tele (Swedish Edition), 1960, No. 1, 53-63. In Swedish.

Numbering schemes for international automatic traffic are first discussed. The C.C.I.T.T. plans for Europe and the Mediterranean region are considered in relation to national numbering schemes, 2-figure international routing numbers, and international isolating numbers which precede the routing number and enable the latter to be separated from the national number scheme of the originating country. Dialling systems, charging and economic accounting between countries for international traffic, and standardized signalling systems are then reviewed. Acoustic tones — ringing, engaged and information tones — are discussed in relation to their rationalization for international working.
G.N.J.Beck

621.395.31 : 681.142

6889 THE CALCULATION OF TRUNK GROUPS FOR OVERFLOW TRAFFIC WITH PROGRAMME CONTROLLED CALCULATING MACHINES. G.Bretschneider.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 1, 23-8 (Jan., 1960). In German.

The "scatter factor" (see Abstr. 1620 of 1957) can be used [Siemens Z., Vol. 33, 17-25 (1959)] for planning the handling of overflow traffic in a telephone exchange. The methods are reviewed and extended to allow arithmetical rather than graphical handling of the problem; a table of the necessary characteristic parameter is given and a numerical example is fully worked out. The method of applying an electronic computer to the problem, using the new type of solution, is discussed and a block diagram given of a programme suitable for a Siemens 2002.
G.A.Montgomerie

621.395.342.24

6890 EVALUATION OF SELECTOR TECHNIQUES. O.Klika.
Slaboproudy Obzor, Vol. 21, No. 6, 321-9 (1960). In Czech.

Existing selectors employed in telephone switching are surveyed and compared on the basis of the following characteristics: size of a selector (expressed by the number of its outlets); shape of the contact bank and the movement of wipers; method of drive; switching speed and the influence of the drive and speed on the logic circuits. An attempt is made to express the characteristics analytically. Performance data of various selector types are indicated in seven tables. It is concluded that the development of selector techniques can today be regarded as being completed, except for their continuous technological progress.
R.S.Sidorowicz

621.395.38

6891 UNLIMITED DIAL PULSE REPETITION. H.B.Taylor.
G.E.C. Telecomm., No. 30, 42-51 (July, 1960).

Describes a simple and inexpensive means of correcting the distortion incurred by dialled pulses when they are repeated from one exchange to another over junction or trunk lines using two telephone-type relays and a capacitor. The circuit is simple to maintain and spares are readily available. To illustrate the operation of the correction circuit, it is assumed that the optimum dial speed is 10 pulses/sec and the dial ratio is 67% break, i.e. the dial contacts remain open for 67 ms for each pulse. However, the same circuit element can be equally applied to any of the common speeds and ratios in use throughout the world.

621.395.51

6892 A CHARACTER-METERED TRANSATLANTIC SWITCHING SYSTEM. I.S.Coggeshall and P.Holcomb, Jr.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 56-64 (1960) = Commun. and Electronics, No. 47 (March, 1960).

The I.M.C.O. (International Metered Communications) System has been introduced to afford economical one-way telegram service over transatlantic, radio, etc. facilities on the basis that the majority of the connections required are always between the same pairs of offices. That is to say, subscriber A in New York normally calls only subscriber A in London; B in New York only B in London and so on. Provision is made for occasional A–B or B–A connections by special calling and switching procedure. Simple standard equipment is used and calls are metered on a character-counting, not timing, basis. The switching operators can make rapid connections with insurance against errors, by means of built-in safeguards. Subscriber's teleprinters include automatic equipment under control of proceed-to-send signal from the switchboard operator to insert a full message-head in the correct format before each message about to be transmitted. A full schematic diagram and block schematic are given, together with photographs of exchange equipment. 13 references.
W.J.Mitchell

TELEPHONE EQUIPMENT COMMUNICATION NETWORKS AND CABLES

621.395.74

6893 MUTUAL DECOUPLING OF TELEPHONE CABLES WITH DIESELHORST–MARTIN TYPE QUADS.
L.Sansone and R.Monelli.
Alta Frequenza, Vol. 29, No. 1, 59-89 (Feb., 1960). In Italian.

Refers to carrier-frequency cables in which the unit of construction consists of two pairs twisted together. The dependence of unwanted coupling on the length of "lay" of the cable is discussed.
V.G.Welsby

ELECTROACOUSTIC APPARATUS

621.395.6 : 621.375.4

6894 CHANGES IN TELEPHONIC AND ELECTRO-ACOUSTIC EQUIPMENT. R.Singer.
Electricien, Vol. 88, 114-17 (June, 1960). In French.

A survey indicating the improvements brought about by the introduction of transistors with their small size and low power requirements. Such advances include the addition of a transistor-amplifier unit to the conventional telephone handset so dispensing with the necessity for holding the instrument, enabling several individuals to listen at the one point and facilitating the installation of extensions. Again, the use of transistors simplifiers the installation of a paging system either of the induction-loop or the r.f. type. Finally brief reference is made to imrpovements brought about in sterophonic recording.
H.G.M.Spratt

621.395.6

6895 LOW-COST TRANSDUCER OPENS UP NEW USES.
F.Massa.
Electronics, Vol. 33, No. 22, 128, 130 (May 27, 1960).

Two barium-titanate disk transducers are described, both having a single circular electrode on one face and two semicircular electrodes on the other, across which the exciting voltage is applied. One type, mounted in foam rubber, is called the free-edge type and vibrates with the outer peripheral portion out of phase with the centre portion. The other type has the circular electrode cemented to the inner face of a hermetically sealed circular box which forms part of the vibrating system. Indoor and outdoor applications using both types are briefly described. Transducers have been made to operate in air at frequencies between 15 and 80 kc/s with bandwidth of 8 kc/s (achieved by tuning) at the higher frequencies.
A.P.C.Thiele

621.395.623.4

6896 A NEW TELEPHONE FOR DEAF SUBSCRIBERS — HANDSET No. 4. W.T.Lowe.
Post Off. elect. Engrs' J., Vol. 53, Pt 1, 24-5 (April, 1960).

A telephone handset containing a single-stage transistor amplifier has been developed to provide amplified reception for deaf subscribers.

621.395.625

6897 A NEW FLUTTERMETER.
W.J.Brown.
Bell Lab. Record, Vol. 38, No. 4, 146-9 (April, 1960).

The KS-16570 fluttermeter together with some of the basic problems of flutter measurement are described. Below 10 variations/sec the subjective effect is that of a tremolo; 10 to 20 variations/sec appear as rapid changes in both loudness and pitch, whilst higher rates produce a harsh effect. Values of 0.2% are commonly perceptible, whilst values of 0.5-1% are intolerable. It is necessary to measure flutter on recorders such as telephone answering machines, etc. The difficulties arising from multiple sources of flutter and the problems arising in previous fluttermeters from the effects of nonlinearity and the need for stable high-gain low-frequency amplifiers are discussed. The new circuit uses a saturated transformer which gives voltage output pulses of considerable magnitude, corresponding to the input waveform zero crossings. This signal is applied to a converter circuit which feeds a meter to which adjustable damping is applied, so as to allow removal of excessive visual fluctuation. The indication is substantially independent of irrelevant factors such as nonlinear distortion and amplitude variations of the test signal. The response is uniform from 0.5 to 120 c/s, full scale readings being 1.5% or 3% flutter. A commercial version is available.
M.L.Gayford

621.395.625

6898 A COMPATIBLE TAPE CARTRIDGE.
M.Camras.
I.R.E. Trans Audio, Vol. AU-8, No. 2, 62-7 (March-April, 1960).

Magnetic recording is recognized as a superior medium for stereophonic entertainment, but its popularity has been handicapped by inconvenience of threading and high cost. A new approach is a tape cartridge of very low cost, which is compact, and fully protects the record. The cartridge is completely automatic on a machine designed for its use, and yet will operate manually on present tape recorders.

621.395.625.2

6899 STEREO DISK PROBLEMS (ADDENDUM).
E.P.Skov.
J. Audio Engng Soc., Vol. 8, No. 3, 154-5 (July, 1960).
See Abstr. 3733 of 1960.

621.395.625.2

6900 MAXIMUM PEAK VELOCITY CAPABILITIES OF THE DISK RECORD. J.W.Stafford.
J. Audio Engng Soc., Vol. 8, No. 3, 152-5 (July, 1960).

A theoretical study of the physical factors which limit the maximum peak velocity over the usable frequency range in disk recording shows there are three regions involved. At low frequencies, amplitude is the controlling factor; at intermediate frequencies, the geometrical shape of the cutting stylus limits the velocity; at high frequencies, the tip radius of the reproducing stylus becomes the limiting factor. These geometrical parameters are then related to the capabilities of the Westrex 3C Stereo Disk recorder at various speeds.

621.395.625.3

6901 AN INVESTIGATION INTO SPEED VARIATIONS IN A MAGNETIC RECORDER WITH THE HELP OF ELECTRO-MECHANICAL ANALOGUES. W.Wolf.
Hochfrequenztech. u. ElektAkust., Vol. 69, No. 2, 41-52 (April, 1960). In German.

Formulae are derived for the electrical equivalents of mass, friction and compliance. The mechanical representation of the drive and its electrical equivalent circuit are given, the latter embodying no less than 18 different elements. The determination of the various components, such as the modulus of elasticity of the tape, and the measurement of the driving motor characteristics are described in detail. Frictional effects are also measured. As a result, values are assigned to the electrical circuit elements as a basis for establishing the optimum means of reducing tape speed variations. Amongst numerous suggestions for improvement, the inclusion of a mechanical filter between wind-off spool and erase head and heavy damping of the driving motor are recommended.
H.G.M.Spratt

621.395.625.3

6902 A COMPARISON OF SEVERAL METHODS OF MEASURING NOISE IN MAGNETIC RECORDERS FOR AUDIO APPLICATIONS. J.G.McKnight.
I.R.E. Trans Audio, Vol. AU-8, No. 2, 39-42 (March-April, 1960).

Various methods of measuring noise are discussed, and data are shown comparing the numbers observed for the different methods (I.R.E. Standard Methods, and others) when applied to the same recorder. This data enables data taken by one method to be compared with data taken by another method. The present audio specifications based only on broad-band noise are shown to be inadequate, as the equipment noise in the range of low hearing sensitivity masks any improvements which may be made in tape noise, or with the Ampex master equalization. A measure of relative audible noise level should be added to the present broad-band measurement.

621.395.625.3

6903 HIGH-DENSITY MAGNETIC RECORDING.
J.J.Brophy.
I.R.E. Trans Audio, Vol. AU-8, No. 2, 58-61 (March-April, 1960).

By improving the mechanical properties of magnetic recording heads and recording media, it has been possible to demonstrate

consistent recordings at information densities up to 40 000 cycles per inch. No fundamental magnetic limit to the maximum recording density has been detected. The major mechanical limitation appears to be the effective head–tape separation due to the mechanical surface roughness of the medium. Tape noise arises from both body and surface effects, but their relative importance is not clear. High-frequency recording in the region of several megacycles introduces no special problems with heads of suitable design, such as the outside coil head. Based on present experimental results, a maximum recording density of the order of 100 000 cycles per inch is predicted.

621.395.625.3

6904 THE FREQUENCY RESPONSE OF MAGNETIC RECORDERS FOR AUDIO. J.G.McKnight.

J. Audio Engng Soc., Vol. 8, No. 3, 146-53 (July, 1960).

The total frequency response of a magnetic tape recorder depends on the amplifier responses, the heads, and the tape. Response standards have been established by N.A.B. and C.C.I.R. for the reproduce chain, using an "ideal" reproduce head and a prescribed post-emphasis. Techniques are discussed and data shown for calibrating the reproduce chain; the ideal reproduce head is physically realizable. The only standard for the record chain is that it must produce tapes which reproduce properly on a standard reproduce chain. Data show that the frequency-dependent response loss of the record chain may be made negligible. A record adjusting tape was chosen and the required pre-emphasis derived. Wavelength-dependent losses are appreciable; their causes are briefly discussed and found to be inherent in the tape and record heads used at present.

621.395.625.3

6905 CHEMICAL ANALYSIS OF MAGNETIC RECORDING TAPE. C.V.Green.

J. Audio Engng Soc., Vol. 8, No. 3, 156-8 (July, 1960).

A scheme is given for the chemical examination of magnetic recording tapes. The tape is first extracted with solvents to remove plasticizer and the base is then separated from the binder and the magnetic oxide. Each of the components is analysed separately, and examples of the results obtained on a number of tapes of German, Russian, and American manufacture are given.

621.395.625.3

6906 A FULL-TRACK, STEREOPHONIC, MAGNETIC RECORD–REPRODUCE HEAD. W.S.Latham.

J. Audio Engng Soc., Vol. 8, No. 3, 165-9 (July, 1960).

A method of recording two tracks of information across the full width of 0.25 in. magnetic tape by superimposing magnetic patterns with a fixed angular relationship is described, together with the development of a special magnetic record–reproduce head assembly.

621.395.625.3

6907 THE USE OF 35-mm SPROCKET-TYPE MAGNETIC FILM IN RECORDING PHONOGRAPH MASTERS. J.G.Frayne and J.W.Stafford.

J. Audio Engng Soc., Vol. 8, No. 3, 172-6 (July, 1960).

Discusses the use of perforated 35 mm magnetic film as the recording medium in preparing phonograph masters. The Westrex 35 mm system is described. Performance characteristics are given. A comparison of 35 mm magnetic film versus $\frac{1}{4}$ in. magnetic tape relative to flutter, signal-to-noise ratio, print-through, modulation noise, and intermodulation distortion is given.

621.395.625.3

6908 THE EFFECT OF A.C. BIAS WAVEFORM ON HARMONIC DISTORTION IN MAGNETIC TAPE RECORDING. R.P.Schroeder.

J. Audio Engng Soc., Vol. 8, No. 3, 192-8 (July, 1960).

The effect of a.c. bias waveform on harmonic distortion in magnetic tape recording is studied analytically and experimentally. An analysis of square-wave bias is performed, following methods used by Camras and Zenner, using the same power series approximation to a B_r-H curve as used by Zenner. Comparing these results to those obtained by Zenner for sinusoidal bias, square-wave bias is found to result in higher output and higher percentage distortion. The analysis is extended to nonsymmetrical rectangular bias, for which the distortion is found to be much greater. The experiments are performed by generating various voltage waveforms at 20 kc/s and feeding them through a current feedback amplifier to a record head, where they serve as bias and are superimposed on 1 kc/s sinusoidal audio signals. The results indicate little difference in distortion between sinusoidal and square-wave bias but greatly increased distortion for any type of unsymmetrical bias. A comparison is made between the analytic and experimental results in an attempt to evaluate two different theories on the mechanism of a.c. bias. It is concluded that both theories are valid but for different relationships between gap length and bias wavelength.

621.395.625.3

6909 AN ANSWERING SET FOR TELEPHONE SUBSCRIBERS. F.L.Randall.

Post Off. elect. Engrs' J., Vol. 53, Pt 1, 45-8 (April, 1960).

Design requirements are suggested for a device which will answer a telephone call and give a recorded message when the called subscriber is absent. The way in which these requirements are met by the Post Office Answering Set No. 1 is described.

RADIOCOMMUNICATION

621.396.1

6910 THE COMPATIBILITY PROBLEM IN SINGLE-SIDEBAND TRANSMISSION. K.H.Powers.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1431-5 (Aug., 1960).

Under the assumption of simultaneous amplitude and phase modulation of a carrier, a study is made of the relations that must hold between the envelope and the phase of a single-sideband wave. In particular, it is shown that absolute compatibility with standard a.m. receivers employing a linear envelope detector cannot possibly be achieved with the spectral economy of conventional single-sideband. On the other hand, if one conveys the message function in the square of the envelope rather than in the envelope itself, it is shown that a phase function can be found for which the hybrid wave occupies a spectral width equal to that of a conventional single-sideband system. Distortionless detection is achieved with a square-law envelope detector. The operations required to generate this square-law s.s.b. signal are described in detail.

621.396.2 : 621.396.65

6911 RESULTS FROM A THREE-HOP TROPOSPHERIC SCATTER LINK IN NORWAY WITH PARALLEL OPERATIONS ON 900 mc AND 2200 mc. N.H.Knudtzon and P.E.Gudmandsen.

I.R.E. Trans Commun. Syst., Vol. CS-8, No. 1, 20-6 (March, 1960).

A three-hop troposcatter system is described briefly. From measurements on a 360 km hop in the period October 1957 to June 1958, it is concluded that (1) the monthly amplitude distributions are approximately Gaussian, and the 1 minute amplitude distributions are approximately of the Rayleigh type; (2) the signals are generally considerably stronger (differences up to the order of 10 dB) in summer than in winter; (3) the monthly median strength of the 900 Mc/s signals is generally 0-2 dB stronger than that of the 2200 Mc/s signals; (4) the foreground conditions may be critical; (5) the 1 minute fade duration distributions are approximately log-normal; (6) there are indications that the normalized 1 minute fade duration distributions are about equal for 900 and 2200 Mc/s; (7) considerable reductions in telegraph error rate are effected by increasing orders of diversity reception; (8) the telegraph error rates are equal for 900 and 2200 Mc/s signals of equal median strengths; (9) frequency-modulated telegraph multiplex equipment is slightly superior to two-tone telegraph multiplex equipment, when adjusted to equal loadings; (10) aerial radiation diagrams depend critically on local surroundings, such as woods.

TRANSMITTERS . RECEIVERS

621.396.6 : 621.374.3

INSTRUMENTATION FOR COMPLEX SIGNAL ENVIRONMENT TESTING. See Abstr. 6759

621.396.61

6912 B.O.A.C.'S BOEING 707: COMMUNICATIONS AND NAVAIDS. R.O.Bradley.

Brit. Commun. and Electronics, Vol. 7, No. 7, 494-9 (July, 1960).

621.396.61

6913 THE TRANSMITTER OF THE BISAMBERG MEDIUM-WAVE HIGH-POWER BROADCASTING STATION AND ITS POWER SUPPLY. H.Kikinger.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 9-10, 200-11 (May 1, 1960). In German.

An illustrated general description, with block diagrams showing the general arrangements. There are 4 transmitters with output powers of 120 kW, which can be coupled in pairs with outputs of 240 kW, each of these coupled transmitters radiating the first and second programmes of the Austrian broadcasting system on the frequencies of 1475 and 584 kc/s. Quartz control gives a frequency constancy within 1 part in 10^6 over a 24 hour period. Some details are given of the h.f. control arrangements, which may use either a quartz oscillator, a variable oscillator, or special common-frequency control equipment giving constancy better than 1 part in 10^9 for 24 hours, also of the phase-control stage and the power amplifier, which uses 3 triodes in parallel. The high-voltage rectifier, the general cooling system, and the standby plant arrangements are also described. The transmitter power is normally obtained from the Vienna 20 kV network, Diesel-driven generators serving as a reserve. A.Wilkinson

621.396.621

6914 TRANSISTORIZED AUTOMOBILE RECEIVERS EMPLOYING DRIFT TRANSISTORS.
R.A.Santilli and C.F.Wheatley.
Semiconductor Prod., Vol. 3, No. 6, 29-35 (June, 1960).

Describes six all-transistor automobile radios designed to use a five-stage lineup including r.f. amplier, converter, i.f. amplifier, first-audio, and power-output stages. The six receivers differ in having three-coil or four-coil tuners and Class A or Class B output. All six variations have a sensitivity of approximately 2 μV aerial signal for 1W of audio power. Sensitivity for a 20-dB signal-to-noise ratio is 5-10 μV (depending upon circuit). The Class-A output circuit delivers about 4W of undistorted power and the Class-B output circuit about 8W of undistorted power. The receivers "overload" at about 1V on the aerial.

RADIOFREQUENCY EQUIPMENT

621.396.66

6915 THE COMMON-FREQUENCY CONTROL OF THE BISAMBERG HIGH-POWER TRANSMITTING STATION.
G.Klement.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 9-10, 221-4 (May 1, 1960). In German.

The arrangements for controlling the 584 kc/s transmissions from the Bisamberg, Klagenfurt and Salzburg stations are based on a standard frequency of 1 kc/s derived from a high-precision quartz clock in the central broadcasting station, Vienna. This frequency is used for amplitude modulation of a 5.2 kc/s carrier, which is transmitted in various ways to the transmitting stations and there used to effect comparison between the standard frequency and that derived from the station's quartz oscillator. Details are given, with block diagrams, of the equipment in use at the Bisamberg station. Automatic control of the station's quartz oscillator gives a frequency constancy to within 1 part in 10^9 for an hour. Any frequency drift is shown on the screen of a c.r.o. A.Wilkinson

621.396.662 : 621.397.62

6916 TRANSISTORIZED TV AND F.M. TUNERS.
K.Wittig.
Semiconductor Prod., Vol. 3, No. 7, 19-25 (July, 1960).

Describes some of the design considerations for v.h.f. front ends, using m.a.d.t. and mesa transistors as r.f. amplifiers, mixers and oscillators. Both common-emitter and common-base configurations are compared as to their characteristics and suitability. Practical applications are explained by means of proprietory TV and f.m. tuner schematics. Input and interstage matching are discussed together with a.g.c. methods and their effect on bandpass characteristics.

AERIALS

621.396.67

6917 ON MEASUREMENTS OF MICROWAVE $\bar{E}$ AND $\bar{H}$ FIELD DISTRIBUTIONS BY USING MODULATED SCATTERING METHODS. Ming-Kuei Hu.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 295-300 (May, 1960).

The modulated scattering method of Justice and Rumsey (see Abstr. 2556 of 1956) and Richmond (see Abstr. 1385 of 1956) for measuring $\bar{E}$ field distribution is extended to the measurement of $\bar{H}$ field distribution by using a loop scatterer formed by two diodes. This diode loop method has the particular advantage of eliminating the large and undesirable effect produced by the associated $\bar{E}$ field when measuring the $\bar{H}$ field. A scattering analysis of the modulated diode loop is presented. It explains the principle of this new method and also supports the advantage mentioned above. A similar analysis for the modulated diode scatterer based upon this analysis for the $\bar{E}$ measurement is more satisfactory than that given by Richmond which is based upon a qualitative description of the diode scatterer.

621.396.674

6918 CYLINDRICALLY SYMMETRICAL BROADBAND OMNI-DIRECTIONAL RADIATOR WITH H.F. MATCHING.
H.Meinke.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 4, 161-8 (April, 1960). In German.

Examines a particular form of a broadband radiator whose input impedance is largely frequency-independent over a wide band of frequencies. A reflection-free transition over this band from the feeder cable to the radiator is assumed. The optimum form of the radiator was calculated and experimental results in the range 200 to 4000 Mc/s show that the lower limit of the h.f. passband for all forms of the aerial considered lies where the aerial height $\cong 1/4\lambda_0$. The experimental results for the input impedance of the aerial also agree well with the approximate calculation applicable to the low-frequency end of the band. Z.F.Voyner

621.396.674.3

6919 THEORY OF COUPLED FOLDED ANTENNAS.
C.W.Harrison, Jr and R.King.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 131-5 (March, 1960).

Formulae for the mutual and self-impedance of two identical nonstaggered parallel-folded dipoles are developed. A generalization of the theory permits determination of these impedances for any identical dual configuration of wires, no matter how complicated, provided the structures are symmetrical with respect to the driving points. If the impedance of any single-conductor solid-wire element in a symmetrical circular array of linear radiators is known, the impedance of each element in a similar array consisting of folded-wire structures is readily obtained. Two obvious practical uses of the theory are: (1) the determination of the performance of a two-element folded aerial array, when one aerial is a tuned parasite, functioning as a director or reflector; and (2) determination of the driving-point impedance of a folded aerial parallel to a highly conducting plane.

621.396.674.3

6920 LOG PERIODIC DIPOLE ARRAYS.
D.E.Isbell.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 260-7 (May, 1960).

A new class of coplanar dipole arrays is introduced providing unidirectional radiation patterns of constant beamwidth and nearly constant input impedances over any desired bandwidth. The broadband properties are achieved by making use of the principles of log periodic design. Models are discussed which are capable of providing 8- to 9-dB directive gain with an associated input standing-wave ratio of 1 : 2 : 1 on a 75 ohm feeder, and this performance is independent of frequency. The free-space properties of several of these arrays were measured and the results are presented. The aerial configuration is simple, permitting practical methods of fabrication, and the design should prove useful in many applications. It makes possible, for example, the construction of "all-wave" rotatable beams of very low cross-section for use in the h.f. to u.h.f. spectrum.

621.396.674.3 : 538.56

6921 RESPONSE OF A LOADED ELECTRIC DIPOLE IN AN IMPERFECTLY CONDUCTING CYLINDER OF FINITE LENGTH. C.W.Harrison, Jr and R.W.P.King.
J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 289-93 (May-June, 1960).

Analytical relationships are developed which permit calculation of the power in the load impedance of an electric probe, symmetrically located within an imperfectly conducting cylinder of small radius compared to the wavelength, in terms of the electric field incident upon the cylinder.

621.396.676

6922 THE FLIGHT EVALUATION OF AIRCRAFT ANTENNAS. G.W.Leopard.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 158-66 (March, 1960).

Reviews the parameters involved in flight evaluation of communication–navigation–identification aerials installed on new types of aircraft to confirm model measurements. The predicted signal level across the receiver terminals connected to an isotropic aerial is employed as the standard of comparison with the scale-model patterns. Procedures employed and results obtained are briefly discussed.

621.396.677

6923 FEEDING POINT IMPEDANCE OF DIRECTIONAL ANTENNA SYSTEMS COMPRISING HALF-WAVE RADIATORS. E.Istvánffy.
Acta tech. Hungar., Vol. 28, No. 3-4, 309-20 (1960).

As a result of mutual interaction between the individual radiators comprising a medium-wave broadcasting aerial the phase constant and, consequently, the input impedance will undergo rapid changes. A method is proposed for calculation of the input impedance, the location of the current minima and the phase-shift between these minima and input to the aerial. Approximate design data can also be calculated by a graphical method described.
Z.F.Voyner

621.396.677

6924 CALCULATING FOLDED-UNIPOLE ANTENNA PARAMETERS. G.J.Monser.
Electronic Industr., Vol. 19, No. 1, 96-8, 172-4 (Jan., 1960).

In low-frequency applications the folded unipole can be made to yield radiated field intensities somewhat greater than those of the stub aerial for a given driving current. The driving point impedance can be adjusted to have a much lower Q than a conventional stub. The condition for very low Q-values, while maintaining good radiation efficiency, obtains when the downlead tuning impedance is made predominantly inductive. Good agreement exists between theory and practice.
Z.F.Voyner

621.396.677

6925 HELICAL BEAM ANTENNA. A.G.Holtum.
Electronics, Vol. 33, No. 18, 99-101 (April 29, 1960).

Presents experimental results obtained on an aerial consisting of two bifilar helices designed for a centre frequency of 240 Mc/s. A simple expression for the radiation pattern is derived and compared with the measurements made over 1.5 to 1 frequency band. Compared with a single helix the results show that the interlaced structure has improved directivity and lower side-lobes. The effect of the change of the relative phase at the two feed points is shown on the measured patterns.
Z.F.Voyner

621.396.677

6926 THE ELECTRICAL EQUIPMENT OF THE BISAMBERG AERIAL INSTALLATION. R.Kayser.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 9-10, 211-19 (May 1, 1960). In German.

Describes the feeding arrangements for the two vertical masts, of lengths respectively 265 m and 100 or 120 m, for the two frequencies of 564 and 1475 kc/s, with illustrations of the foot insulators, tuning capacitors, feeder lines, etc.
A.Wilkinson

621.396.677

6927 SPIRAL ANTENNAS. W.L.Curtis.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 298-306 (May, 1960).

The radiation fields of the Archimedes spiral are derived by approximating the spiral with a series of semicircles. The calculated patterns are shown to have excellent correlation with experimentally determined patterns. It is shown that the high-frequency limit is determined by the feed configuration and that the low-frequency limit occurs when the outside diameter is a little greater than a half wavelength.

621.396.677

6928 THE ARCHIMEDEAN TWO-WIRE SPIRAL ANTENNA. J.A.Kaiser.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 312-23 (May, 1960).

A pair of equally excited but oppositely sensed Archimedean two-wire spirals situated close to one another in the same plane — a doublet — is used to generate a linearly polarized field in which the direction of polarization and phase are controlled or varied independently of each other by rotation of the spiral radiators. An array of these doublets can be made to scan by rotation of the several spiral elements; an eight-doublet array which was made to scan over an 83° sector with small amplitude variation is discussed. A doublet fed from a ring network can be employed as a polarization diversity circuit. A virtual doublet is achieved by placing a single spiral in a right angle trough. A preliminary scanning array comprising four spirals in a trough was made to scan ±36°. The possibility of using a parasitic spiral in conjunction with a driven spiral for obtaining linear polarization of variable direction and phase is indicated. A brief simplified analysis of the two-wire Archimedean spiral is also presented, which leads to the concept of higher-order modes of radiation.

621.396.677

6929 TELEMETRY RECEIVING ANTENNAS AT CAPE CANAVERAL. H.A.Roloff.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 43-7 (June, 1960).

Aerials used for gathering telemetry data from guided missiles and earth satellites are briefly described. A general description of the launching facilities at Cape Canaveral is presented, and the purpose of the radio telemetry data transmission from test vehicles is related. The requirements for receiving the radio frequency energy transmitted from the rockets in the v.h.f. band, and the ways that these requirements were met are discussed. The performance capabilities and operational utilization of the telemetry aerials are described. Some significant test results of this instrumentation system are outlined, and the current methods of testing the aerials to insure adequate instrumentation coverage is presented.

621.396.677.3

6930 LINEAR ARRAYS WITH ARBITRARILY DISTRIBUTED ELEMENTS. H.Unz.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 222-3 (March, 1960).

A linear array with general arbitrarily distributed elements is discussed. A matrix relationship is found between the elements of the array and its far-zone pattern. The lower bound of the stored energy and the Q-factor of the array are found. A figure of merit for the array is defined.

621.396.677.3

6931 A NEW MATHEMATICAL APPROACH FOR LINEAR ARRAY ANALYSIS. D.K.Cheng and M.T.Ma.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 255-9 (May, 1960).

It is well known that linear arrays are representable mathematically by polynomials. However, even for the simplest case of a uniform array, properties of its radiation pattern are conventionally analysed by examining the transcendental form of the array factor and some of its important characteristics have been determined only approximately. For a more general array, a closed form of the associated polynomial is usually not obtained and the anlysis becomes quite difficult. A new approach for linear array analysis is proposed. Basically, the current distribution in the discrete elements of a linear array is considered as the sampled values of a continuous function. Known relations in Z transforms developed for sampled-data systems can then be used to express the array polynomial in a closed form. Mathematical techniques for determining important properties of the array pattern are developed. Typical examples illustrating the applications of this new approach are given.

621.396.677.3

6932 MUTUAL IMPEDANCE EFFECTS IN LARGE BEAM SCANNING ARRAYS. P.S.Carter, Jr.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 276-85 (May, 1960).

An analysis is presented of the driving-point impedance of the elements in a flat array of infinite vertical height but finite horizontal width. It is assumed that each of the elements is fed by a separate amplifier, having infinite internal impedance, and that the amplifiers can be phased to direct the beam at various positions in space. The radiating elements considered are infinitely long wires spaced on half-wavelengths centres and half-wave dipoles spaced on half-wavelength centres, each backed by a conducting ground plane spaced $\lambda/4$ from the elements. Values of driving-point impedance are computed for the 61 elements in arrays 30 wavelengths wide. Values of the driving-point impedance near the centre of the array are found to agree closely with the values computed for infinitely wide arrays while the driving-point impedance of elements near the edge of the array are found to deviate considerably from the values at the centre.

621.396.677.4

6933 BEAM POINTING ERRORS OF LONG LINE SOURCES. M.Leichter.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 268-75 (May, 1960).

The relation between the statistics of the aerial beam pointing direction and the phase and amplitude errors at the source was obtained to first order in the mean-square errors, under certain restrictions, for long line sources. It is shown that when the desired phase at the source is a constant, the results are, to first order, independent of the amplitude errors. When the desired amplitude is also constant, there is a simple formula for computing the allowable r.m.s.-phase error at the source when the pointing direction is required to lie in a given angular range with a given probability. When the amplitude distribution corresponds to the Taylor-modified $(\sin x)/x$ pattern, the allowed r.m.s.-phase error is obtained from the constant-amplitude case by a multiplicative factor which depends only on the one parameter characterizing the Taylor distribution. This function is plotted for the range corresponding to sidelobe ratios of 13.2 to 40 dB. At 40 dB the allowed r.m.s.-phase errors are about three fourths of the allowed r.m.s.-phase errors at 13.2 dB (constant amplitude) for the same uncertainty in the pointing direction. The results are applied to a hypothetical example and to an actual "Mills Cross" for illustrative purposes.

621.396.677.55 : 538.56

6934 IMPEDANCE CHARACTERISTICS OF A UNIFORM CURRENT LOOP HAVING A SPHERICAL CORE. S.Adachi.
J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 295-9 (May-June, 1960).

The radiation impedance is derived by the electromotive force method in a convenient form as the sum of the self-radiation impedance of a loop in the free space and an additional term due to the reaction between the loop and the sphere which is proportional to the well-known expansion coefficient of a magnetic-type scattered wave from a sphere in an incident plane wave. The first anti-resonance frequency has been given in the form of a universal curve for a very small uniform current loop with core of an arbitrary composition of μ_s and ϵ_s, subject to the condition that the refraction coefficient $N = \sqrt{\mu_s \epsilon_s}$ is extremely large. Some numerical calculations show that high $-\mu$ core is desirable for a comparatively lower frequency region, and high $-\epsilon$ core is rather desirable in an antiresonance region.

621.396.677.71

6935 THE SLOT ANTENNA WITH COUPLED DIPOLES. R.W.P.King and G.H.Owyang.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 136-43 (March, 1960).

The problem of an array consisting of a slot aerial and two symmetrically located cylindrical dipoles is formulated. The approximate distribution of the current along each aerial is obtained by a method of iteration. The radiation function, the coupling coefficients between the slot and the dipole, the relation between the magnetic current in the slot and the electric current in the dipole, and the input impedance of the slot in the presence of the dipoles were obtained. An experimental setup for measuring the radiation patterns is described and measured and theoretical patterns are displayed.

621.396.677.71

6936 MUTUAL COUPLING EFFECTS IN LARGE ANTENNA ARRAYS. I. SLOT ARRAYS. S.Edelberg and A.A.Oliner.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 286-97 (May, 1960).

A periodic structure approach is presented for the analysis of the impedance properties of large arrays. The method is applied to a two-dimensional array of slots, in which each slot is fed by a separate waveguide and the array radiates into a half-space. The slot spacing and progressive phasing in the array may be arbitrary, however. The periodic structure approach permits a waveguide-type analysis of the half-space which automatically includes all mutual coupling effects. Both the susceptance and conductance of the slot are evaluated for arbitrary scan angle, and the effects associated with the appearance of higher order beams are considered.

621.396.677.75

6937 COUPLED LEAKY WAVEGUIDES. I. TWO PARALLEL SLITS IN A PLANE. S.Nishida.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 323-30 (May, 1960).

Theoretical expressions are derived for the effects of mutual coupling between two parallel leaky-wave aerials located in an infinite plane. The leaky wave aerials treated are slitted rectangular waveguides, the propagation constants of which are modified by the coupling. It is shown that the attenuation constants are influenced significantly but that the phase constants are changed only slightly, so that the coupling is different from that between neighbouring surface-wave lines. The nature of the coupling effects are illustrated by numerical calculations.

621.396.677.83

6938 EXPERIMENTAL STUDY OF A DIFFRACTION REFLECTOR. J.H.Provencher.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 331-6 (May, 1960).

A microwave aerial was designed and constructed on the principles of parageometric optics formulated by Toraldo di Francia (see Abstr. 2717 of 1958) and on principles similar to those of Fresnel rings and the diffraction grating. Its surfaces are all zones of cones and are simple to construct. The chosen design parameters were incorporated in two K-band (λ = 1.24 and 1.22 cm) models. Experimental results show good agreement with theory. Scanning characteristics are superior to those of the paraboloidal or spherical reflector, and spherical aberration and coma are minimized, and the effects of astigmatism are minimized by using a "compromise focus".

621.396.677.832

6939 RADIATION PATTERNS OF FINITE-SIZE CORNER-REFLECTOR ANTENNAS. A.C.Wilson and H.V.Cottony.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 144-57 (March, 1960).

Radiation patterns were measured for corner reflectors having various combinations of width and length of the reflecting surfaces. The widths range from 1 to 10λ the lengths from 0.5 to 5λ. The aperture angle was, in general, set at a value required to maximize the gain. Radiation patterns are arranged according to the size of the reflecting surfaces. The effect of the width and length of the surfaces on the width of the main lobe and on the level of the radiation to the rear is summarized in a series of curves. A corner reflector with a collinear array of dipoles was designed, constructed, and tested to have sidelobe radiation below the −40 dB level.

621.396.677.833.2

6940 BROADBAND PARABOLIC AERIALS FOR DECIMETRIC WAVELENGTHS WITH HELICES AS PRIMARY RADIATORS. R.Herz.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 3, 109-14 (March, 1960). In German.

Helical primary radiators can be used at L-band for the illumination of the paraboloids of revolution with diameters of several metres. By comparison with dipoles as primary radiators these aerials are broadband and well matched because of their circular polarization and absence of destructive interference between the feed and reflector. Complete design procedure and experimental results are given for helical feeds illuminating para-

bolic reflectors with diameters of two and three metres and having an aperture angle of 66° in each case. Measurements were made in the 600 to 1000 Mc/s band. Z.F.Voyner

621.396.677.85

6941 MICROWAVE PROPERTIES OF METAL-FLAKE ARTIFICIAL DIELECTRICS. Krishnaji and S.Swarup.
J. Inst. Telecomm. Engrs. (New Delhi), Vol. 6, No. 1, 38-46 (Dec., 1959).

Experimental results are given of measurements of effective permittivity of metal flake suspensions in insulating media. Various materials and dispersion densities, using particles in the range 10 to 100μ, were investigated at several frequencies in the range 480-10 045 Mc/s. Experimental results are compared with those expected from known theories and reasons for some of the discrepancies are suggested. A.E.Karbowiak

621.396.679

6942 GROUND CONSTANT MEASUREMENTS USING A SECTION OF BALANCED TWO-WIRE TRANSMISSION LINE. E.J.Kirkscether.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 307-12 (May, 1960).

When an open-circuited section of unshielded balanced two-wire transmission line is introduced perpendicularly into earth (or some sample under test), the electrical characteristics of the latter may be found by simple input-impedance measurements. By laboratory sample measurements the classical short- and open-circuited method can be used. Some exact and approximate procedures are presented and their utility and practical limitations discussed. Some precautions as to how possible errors and inexactnesses in the measurements and following calculations may be avoided are given. As an example, a typical earth sample is tested in a frequency range from 0.6 to 400 Mc/s, with graphical representation of the most important electrical constants: conductivity, dielectric constant, attenuation, velocity of propagation, etc., which exhibit great variations in the frequency range cited. The measurement method presented seems to be adequate to use in small mobile equipment, with which the ground in general can be tested in its original site and under natural conditions without the necessity of being removed.

621.396.679.4

6943 A PRINTED CIRCUIT BALUN FOR USE WITH SPIRAL ANTENNAS. R.Bawer and J.J.Wolfe.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 3, 319-25 (May, 1960).

A novel printed circuit balun is described which is particularly well suited to applications where space is at a premium. The design utilizes unshielded strip transmission line, but is readily adaptable to all of the common printed circuit transmission line techniques. When the balun is housed within the cavity of a spiral aerial, boresight error is virtually eliminated, ellipticity ratios of less than 2 dB are maintained over an azimuth angle greater than ±60°, and the input standing-wave ratio is less than 2 : 1 over an octave frequency range. Experimental results are given and additional applications are described.

PROPAGATION . INTERFERENCE

621.391.81

6944 AN ANALYSIS OF PROPAGATION MEASUREMENTS MADE AT 418 MEGACYCLES PER SECOND WELL BEYOND THE RADIO HORIZON (A DIGEST).
H.B.Janes, J.C.Stroud and M.T.Decker.
J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 255-7 (May-June, 1960).

During an 18-month period in 1952 and 1953, transmission loss measurements at 418 Mc/s were made over a 134 mile path between Cedar Rapids, Iowa, and Quincy, Illinois. Continuous recordings made simultaneously at several receiving-aerial heights from 30 to 665 ft yielded information on diurnal and seasonal variations in both the hourly median basic transmission loss and in height gain. These data are compared to predictions made using the method developed by Rice, Longley, and Norton and are found to be in good agreement, particularly at the lower aerial heights. An analysis of the correlation of short-term signal-level variations observed at horizontally and vertically spaced aerials is described.

621.391.812.3

6945 RAPID FREQUENCY ANALYSIS OF FADING RADIO SIGNALS. J.M.Watts and K.Davies.
J. geophys. Res., Vol. 65, No. 8, 2295-301 (Aug., 1960).

Examples of frequency analysis of fading radio signals for long periods of time are demonstrated, and the method of obtaining them is explained. They include both regular h.f. propagation and v.h.f. ionospheric forward-scatter samples. The procedure is also useful for the analysis of other natural phenomena having long time scales and slow variations.

621.391.812.6

6946 PROPAGATION AT 36 000 MC IN THE LOS ANGELES BASIN. W.L.Flock, R.C.Mackey and W.D.Hershberger.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 235-41 (May, 1960).

Fading characteristics at 36 G c/s over a line-of-sight path in the Los Angeles basin are shown to be closely correlated with meteorological conditions, particularly with the relatively persistent, low-level temperature inversion of the area. No positive evidence of the influence of atmospheric pullutants was found, but it is shown that suitably located microwave paths can be of value for locating and monitoring temperature inversions when they are accompanied by sufficient variation in water-vapour content. The relation of diurnal variations in propagation characteristics to diurnal variations in the temperature inversion and in atmospheric turbulence indicate that the refraction mechanism is the predominant one in causing the observed large fading amplitudes. The view is further strengthened by the relatively noncritical relation of fading to the proximity of the inversion layer.

621.391.812.6

6947 THE ABSORPTION OF CENTIMETRE WAVES IN A STRATIFIED ATMOSPHERE.
S.A.Zhevakin and V.S.Troitskii.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 21-7 (Jan., 1959).
In Russian.

Complete calculations are given for the absorption of centimetre waves in the atmosphere taking account of the curvature of the earth and refraction. The dependence of absorption coefficient on altitude is calculated and general expressions are derived enabling the absorption to be determined for a given temperature and absolute humidity on the earth. R.C.Glass

621.391.812.61

6948 A THEORY OF WAVELENGTH DEPENDENCE IN ULTRAHIGH FREQUENCY TRANSHORIZON PROPAGATION BASED ON METEROLOGICAL CONSIDERATIONS.
R.Bolgiano, Jr.
J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 231-7 (May-June, 1960).

Recent radio data indicate that the wavelength dependence of ultrahigh frequency transhorizon propagation varies widely in time. This is in contradiction with theoretical explanations previously set forth. Each attempt to account for the underlying effects of ever-present atmospheric motions has, in the past, pointed toward a unique form of the dependence. Extensive discussions have resulted as to the validity and relative merits of the various forms, but at no time has a variable wavelength dependence been proposed. Since scatter propagation theory has predicted so satisfactorily the broad aspects of the radio signals, it is retained as the basis for further analysis. A new model is developed for the structure of refractive index fluctuations induced by turbulence. Based on a theory of homogeneous turbulence in a stably stratified atmosphere, which has been developed concurrently by the author, this new model provides an explanation for the observed distribution of wavelength dependence. It suggests that at times when the dynamic stability of the air within the scattering volume is neutral the received power should be nearly independent of radio wavelength. On the other hand, when the atmosphere is dynamically stable the signal strength should be proportional to the square, or higher power, of the wavelength. These predictions have been tested by comparing the results of a scaled-frequency experiment with simultaneous meteorological data gathered along the path. Richardson's number for the 1 to 3 km layer, within which the principal scattering volume lies, has been employed as an index of dynamic stability, though it falls short of ideal in some respects. The 0.8 value of correlation found between Richardson's number and the wavelength dependence is highly suggestive that a relation of the nature predicted does, in fact, exist.

621.391.812.61

6949 A PRELIMINARY STUDY OF RADIOMETEOROLOGICAL EFFECTS ON BEYOND-HORIZON PROPAGATION.

F.Ikegami.

J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 239-46 (May-June, 1960).

A study was made of American and Japanese radiometeorological data in order to suggest the dominant factors in propagation beyond the horizon. The diurnal variability of radio field-strengths seems to be sensitive to the crossover height of rays tangent to the radio horizon and disappears for crossover heights greater than about 500 m. High hourly median field-strengths were observed in Japan corresponding to the existence of a marked refractive-index discontinuity-layer in a common volume of two aerial beams. The results of these experiments suggest that laminar structures of the atmosphere play an important role in beyond-horizon radio propagation.

621.391.812.621

6950 ON THE CALCULATION OF THE DEPARTURES OF RADIO WAVE BENDING FROM NORMAL.

B.R.Bean and E.J.Dutton.

J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 259-63 (May-June, 1960).

The calculation of non-normal tropospheric bending of radio waves is treated in terms of a reduced-to-sea-level value of the refractive index. This method emphasizes departures of bending from the average bending for the United States and consists of visualizing ray-bending as consisting of two parts; an "average" component and a "departure-from-average" component. The "average" component comprises most of the bending and is obtained accurately from refraction tabulations while the component due to departures is easily obtained by graphical means.

621.391.812.621.3

6951 SUPER REFRACTION IN SOUTH ARABIAN SEA.

S.S.Srivastava and B.K.Gupta.

Defence Sci. J., Vol. 9, No. 4, 272-9 (Oct., 1959).

The phenomenon of super refraction has been investigated in the South Arabian Sea area over a period of nearly two years using radar equipment located at Cochin. From the observations made, the existence of a super-refracting layer seems to be well established during the premonsoon months from January to April each year. This is supported by the existence of M-inversions computed from radiosonde data in the region. Duct heights of 135 feet have been estimated which can trap 1st and 2nd order modes in 3 and 10 cm bands.

621.391.812.622

6952 THE TRADE-WIND INVERSION AS A TRANSOCEANIC DUCT.

M.Katzin, M.Pezzner, B.Y.C.Koo, J.V.Larson and J.C.Katzin.

J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 247-53 (May-June, 1960).

Radiosonde data for stations in the South Atlantic trade-wind belt are analysed to determine the potentialities of the trade-wind inversion as an elevated duct for transoceanic radio transmission. These are supplemented by refractometer soundings made by an aircraft during the latter part of 1958. These records indicate that a duct is present in the majority of the cases. Since it is known that the radiosonde underestimates ducting because of its slow response, it is concluded that a duct is present practically all the time. On the basis of the data analysed, an experiment with two aircraft is suggested to test the propagation of this mechanism. A frequency of around 200 Mc/s appears to be a good choice for an initial experiment.

621.391.812.622 : 538.56

6953 ON THE MODE THEORY OF VERY-LOW-FREQUENCY PROPAGATION IN THE PRESENCE OF A TRANSVERSE MAGNETIC FIELD. D.D.Crombie.

J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 265-7 (May-June, 1960).

The effect of a purely transverse horizontal magnetic field on the propagation of very-low-frequency (v.l.f.) waves is considered. It is shown that the magnetic field introduces nonreciprocity, and that for the propagation along the magnetic equator, the rate of attenuation is less for west-to-east propagation than for east-to-west propagation.

621.391.812.63 : 551.5

6954 VERTICAL DRIFT IN THE E-LAYER OF THE IONOSPHERE DURING GEOMAGNETIC DISTURBANCES.

H.Kohl.

Arch. elekt. Übertragung, Vol. 14, No. 7, 314-16 (July, 1960). In German.

Electric fields appear in the ionosphere during geomagnetic disturbances and cause vertical drift of the ionized plasma. Motion equations of the plasma in a magnetic field are solved by taking into account the relatively high density of the neutral gas which must cause a braking action. It is found that drift velocity is only a few dm/sec and therefore the total rise of the E-layer is too small to be measured by ionospheric recorders. J.M.Silberstein

621.391.812.63 : 538.56

6955 PROPAGATION CONSTANTS FOR ELECTROMAGNETIC WAVES IN WEAKLY IONIZED, DRY AIR.

A.V.Phelps.

J. appl. Phys., Vol. 31, No. 10, 1723-9 (Oct., 1960).

Formulae and graphs are given for the calculation of the propagation constants of an electromagnetic wave in weakly ionized, dry air at ionospheric temperatures in the presence of a magnetic field. Experimental studies of electron collision frequencies in nitrogen and oxygen are reviewed and used to obtain the magnitude and energy dependence of the electron collision frequency in air. The equations for the components of the conductivity tensor are developed taking into account the approximately linear dependence of the electron collision frequency on electron energy. Expressions derived on this assumption are found to be accurate except at low temperatures, high pressures, and low frequencies. The errors resulting from the use of an effective value for the energy independent collision frequency in the Appleton–Hartree equations are evaluated. Procedures are given for the calculation of the propagation constants for electromagnetic waves propagated parallel to and perpendicular to the magnetic field. These results are then applied to the derivation of relations required to reanalyse the ionospheric collision frequency measurements reported by Kane. The use of an effective collision frequency is found to lead to errors comparable to the experimental errors in the ionospheric observations.

621.391.812.63

6956 INFLUENCE OF EARTH CURVATURE AND THE TERRESTRIAL MAGNETIC FIELD ON V.L.F. PROPAGATION. J.R.Wait and K.Spies.

J. geophys. Res., Vol. 65, No. 8, 2325-31 (Aug., 1960).

An account is given of some recent work on the mode theory of v.l.f. ionospheric propagation. Attention is confined to the behaviour of the attenuation coefficient of the dominant mode. The ionosphere is assumed to be a sharply bounded and homogeneous ionized medium. It is indicated that earth curvature increases the attenuation rate by as much as a factor of 2 as compared with the corresponding attenuation for a flat earth. The influence of the earth's magnetic field is also shown to be important. In fact, east-to-west propagation paths suffer much greater attenuation than west-to-east paths. The theoretical results appear to agree well with the experimental data of Taylor (see Abstr. 5206 of 1960).

621.391.812.63 : 538.56

6957 ON THE THEORY OF REFLECTION OF LOW- AND VERY-LOW RADIOFREQUENCY WAVES FROM THE IONOSPHERE. J.R.Johler and L.C.Walters.

J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 269-85 (May-June, 1960).

The rigorous application of the magneto-ionic theory to the calculation of reflection coefficients for a sharply bounded ionosphere model is carried out, illustrated with computations applicable to the D or E-region of the ionosphere. The quasi-longitudinal approximation is derived from this theory and the range of validity of this approximation is illustrated, The restrictions imposed by the use of a sharply bounded model ionosphere are discussed.

621.391.812.63

6958 TECHNICAL CORRECTIONS TO MEASUREMENTS OF THE SPORADIC E-LAYER. H.J.Albrecht.

Proc. Instn Radio Engrs Australia, Vol. 21, No. 5, 345-6 (May, 1960).

A statistical method is described for correcting published ionospheric data for the errors introduced by the station operating conditions.

621.391.812.634 : 538.56

6959 SCATTERING OF RADIO WAVES BY AN IONIZED GAS IN THERMAL EQUILIBRIUM. J.A.Fejer.
Canad. J. Phys., Vol. 38, No. 8, 1114-33 (Aug., 1960).

A theory is developed for the scattering of radio waves by density fluctuations which exist in an ionized gas in thermal equilibrium. Expressions for the frequency power spectrum of the scattered waves are obtained. These expressions make it possible to interpret the results of observations of this type of scattering from the ionosphere in terms of electron density and temperature. It is shown that if the characteristic scale of the scattering irregularities (this scale depends on the wavelength of the incident radio wave and the scattering angle) is much greater than the Debye length then the width of the spectrum of the scattered signal is determined by the thermal velocities (and the collision frequencies if the latter are sufficiently high) of the positive ions, rather than of the electrons. If the characteristic scale is greater than the Debye length then for low collision frequencies the spectrum is flat-topped, with two slightly raised shoulders situated symmetrically above and below the frequency of the incident wave. For high collision frequencies the spectrum has only one maximum situated at the frequency of the incident wave.

621.391.812.634

6960 SOME PROBLEMS CONCERNING THE SCATTERING OF RADIO WAVES IN THE IONOSPHERE. V.D.Gusev.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 12-16 (Jan., 1959). In Russian.

Investigates how the correlation functions of waves scattered by the ionosphere change when the ionosphere is irradiated by plane and divergent waves and how use can be made of the experimental data to obtain the parameters of the scattered radio waves.
R.C.Glass

621.391.822

6961 RECORDING ATMOSPHERIC RADIO NOISE. C.Clarke.
Electronic Technol., Vol. 37, No. 9, 346-9 (Sept., 1960).

An investigation was made of the technique required for tape-recording noise at field stations, using simple equipment, with a view to the recordings then being sent to a central research centre for analysis. The method involves recording the i.f. noise envelope obtained from a receiver with a bandwidth of 300 c/s centred about 10 kc/s. By limiting the replay bandwidth by means of a high-pass filter and adjusting the record bias for optimum response, an amplitude range of 60 dB may be recorded without distortion. The main limitation comes from unwanted amplitude modulation caused by misalignment of the tape and contact variations between the head and the tape. This modulation may be reduced to a standard deviation of between 5 and 10% for half-track recording on professional-type or the highest priced domestic-type equipment. A comparison of noise structure on 24 kc/s obtained from direct measurement and via the medium of tape recording shows that the results are statistically indistinguishable.

621.391.822

6962 THE INPUT IMPEDANCE OF BROADCAST-BAND NOISE-METERS. I.M.Furmanov.
Radiotekhnika, Vol. 15, No. 6, 70-3 (June, 1960). In Russian.

Relations are derived from which the input impedance of a standard Soviet interference meter (0.15 to 20 Mc/s) is calculated. This impedance is small enough to effect readings when used with a standard noise measuring network for connecting to the terminals of industrial noise sources. To overcome this difficulty, an input circuit for the noise meter is proposed which includes a matched attenuator and whose impedance does not vary more than 10% from 150 ohms. In use, an equal resistor would be switched out of the standard noise measuring network. F.Quelon

RADIO APPLICATIONS . RADAR

621.396.933.2 : 621.317.39 : 531.71

INTERNATIONAL SYMPOSIUM ON ELECTRONIC DISTANCE-MEASURING TECHNIQUES. See Abstr. 6072

621.396.96

6963 USING GROUND-CONTROL RADAR TO IMPROVE FLIGHT SIMULATION. P.W.Staiger.
Electronics, Vol. 33, No. 20, 86-7 (May 13, 1960).

Pilot training on an F-86 simulator is extended to provide realistic Ground Controlled Interception (G.C.I.), utilizing G.C.I. site equipment and data links coupled-in with the simulator. Block diagrams and descriptions of the system are given. K.C.Garner

621.396.96

6964 OPTIMUM RADAR INTEGRATION TIME. J.M.Flaherty and E.Kadak.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 183-5 (March, 1960).

The practice of integrating periodic low-level signals with time in order to improve the s.n.r. of a coherent signal in an ambient of incoherent noise is extremely useful and generally understood. In cases where the signal continues as long as the observer desires to integrate, the s.n.r. can of course be improved by lengthening the integration period without limit. However, in the case of a radar system trying to detect a very rapidly approaching target, it is obvious that one does not have an unlimited length of time to perform the signal integration and arrive at a decision. An expression is derived which reveals what the optimum integration period is when the radius of the region to be protected, and the velocity of the approaching target, are known.

621.396.96

6965 AIRCRAFT SCINTILLATION SPECTRA. R.B.Muchmore.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 201-12 (March, 1960).

Using the model of aircraft reflection developed by DeLano (Abstr. 1284 of 1954) the spectra of the reflection signals are found. Spectra for the amplitude of the rectified return, for the angular fluctuation signal associated with a fixed radar line-of-sight (effective radar centre fluctuation), and for the angular fluctuation signal associated with a zero time constant servo (apparent radar centre fluctuation) are derived. Several types of target motion are considered: uniform rotation, random rotation, and rectilinear velocity toward the radar itself. Each of these motions produces a characteristic spectrum and the properties of these spectra are pointed out and their significance in radar system design emphasized. In particular, the importance of the spectral density at zero frequency of the apparent radar centre is shown in relation to systems using very rapid automatic gain control. It is shown that such use of very fast a.g.c. may increase this noise density by a factor of approximately three, and thus increase the system noise.

621.396.96

6966 RADAR TERRAIN RETURN MEASURED AT NEAR-VERTICAL INCIDENCE. A.R.Edison, R.K.Moore and B.D.Warner.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 246-54 (May, 1960).

An experimental programme to investigate the reradiation properties of terrain at near-vertical incidence was carried out. Data were obtained at 415 and 3800 Mc/s, using narrow-pulse type radar at altitudes of 2000 to 12 000 ft over many different target areas. At frequencies over 400 Mc/s most terrain acts as a scatterer of energy even at near-vertical incidence with a back-scattering "radiation pattern" that drops off rapidly as the angle of incidence is increased. An exception occurs for heavily wooded areas which appear as nearly isotropic scatterers. At 415 Mc/s the radar cross-section per unit area at vertical incidence ranges between values of 0.7 for woods to approximately 4 for city targets, while at 3800 Mc/s, the variation ranges between values of 0.8 for woods to about 18 for some city targets. If the ground were a lossless isotropic scatterer, the radar cross-section per unit area would be 2 at vertical incidence. For a wide-beam aerial, the fading range between the level exceeded by 95% of the return pulses and

the level exceeded by only 5% of the return pulses is generally between 12 and 17 dB, except for a few very smooth areas which give considerable specular (nonfading) type of return and have a smaller fading range.

621.396.96

6967 APPARENT THERMAL NOISE TEMPERATURES IN THE MICROWAVE REGION. E.Weger.

I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 213-17 (March, 1960).

The necessary equations are presented for obtaining the noise temperature due to thermal radiation which would be sensed by a receiver with an aerial located at some altitude above the earth. Emission and absorption of radiation by the atmosphere is considered. Calculated overall absorptivities and apparent atmospheric temperatures are given as a function of aerial observation angle for beam paths through the atmosphere. Six wavelengths in the microwave band and three types of weather conditions were chosen for the calculations. Some typical aerial temperatures are presented as examples of the magnitudes of the effects to be expected as a function of the type of surface being viewed, the weather, and polarization.

621.396.96

6968 TWO STATISTICAL MODELS FOR RADAR TERRAIN RETURN. L.M.Spetner and I.Katz.

I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 242-6 (May, 1960).

A statistical approach to radar backscattering from terrain. The normalized radar cross-section, σ_0 is computed for two different terrain models. The value of σ_0 is obtained for both models as a function of grazing angle, θ, and radiation wavelength, λ. The first model is a distribution of isolated independent scatterers such as corner reflectors. For such surfaces a wavelength dependence for σ_0 is obtained, and, depending upon the density of scatterers and their average size, the theoretical results indicate that the local dependence of σ_0 on λ can be as λ^{-6}, λ^{-4} or λ^{-2}. For such surfaces, σ_0 is independent of θ. Where reflection occurs from specularly reflecting facets on the surface and where the distribution of surface slopes is Gaussian, the θ dependence turns out to be of the form

$$e^{-k \cot^2 \theta / 2 s_0^2}$$

where s_0 is the standard deviation of the surface-slope distribution. The precise form of σ_0 depends upon the space spectrum of the slopes. Two cases are worked out, one where such a spectrum is flat out to some cutoff, and the other where the space spectrum has a single peak at a particular wave number. In either case, for small enough λ, σ_0 varies as λ^{-2}. As the wavelength becomes large compared to the facet size, the facet no longer behaves as a specular reflector and instead becomes more like an isotropic scatterer. For any particular wavelength one may expect that the radar return be the result of the addition of two types of backscattering. The large facets will behave as specular-type reflectors, while the smaller facets will act as the isotropic scatterers discussed in the first model.

621.396.96 : 523.16

6969 A THEORY OF RADAR SCATTERING BY THE MOON. T.B.A.Senior and K.M. Siegel.

J. Res. Nat. Bur. Stand., Vol. 64D, No. 3, 217-29 (May-June, 1960).

A theory is described in which the moon is regarded as a "quasi-smooth" scatterer at radar frequencies. A scattered pulse is then composed of a number of individual returns each of which is provided by a single scattering area. In this manner it is possible to account for all the major features of the pulse, and the evidence in favour of the theory is presented. From a study of the measured power received at different frequencies, it is shown that the scattering area nearest to the earth is the source of a specular return, and it is then possible to obtain information about the material of which the area is composed. The electromagnetic constants are derived and their significance discussed.

621.396.96 : 523.16

6970 RADIO FREQUENCY SCATTERING FROM THE SURFACE OF THE MOON.

R.L.Leadabrand, R.B.Dyce, A.Fredriksen, R.I.Presnell and J.G.Schlobohm.

Proc. Inst. Radio Engrs, Vol. 48, No. 5, 932-3 (May, 1960).

Observations using a high-power 400 Mc/s radar show that the moon behaves not only as a diffuse reflector but also as a diffuse scatterer. In addition to the strong signal returned from the central region of the lunar surface weak transient echoes are observed from the entire lunar surface within view of the earth. C.Hazard

621.396.96

6971 THE ACCURACY OF MEASUREMENT OF PARAMETERS OF A RADAR EMPLOYED FOR METEORIC OBSERVATIONS. E.I.Fialko.

Radiotekhnika, Vol. 15, No. 6, 67-9 (June, 1960). In Russian.

The number of meteors registered per hour depends among others on the following parameters: transmitter pulse power, directivity of the aerial, wavelength, threshold signal power and distribution law of meteors according to their mass. It is shown that high sensitivity equipment is less influenced by the change of above parameters. The limits of accuracy of the parameters are evaluated for a required accuracy of measurement of the number of meteors. 6 references. A.Woroncow

621.396.968

6972 SIGNAL DETECTION IN THE PRESENCE OF NORMAL NOISE AND RANDOM REFLECTIONS. V.D.Zubakov.

Radiotekhnika i Elektronika, Vol. 4, No. 1, 28-38 (Jan., 1959). In Russian.

The theory of the optimum detection of a radar signal with a known Doppler frequency-shift in the presence of noise and random reflections is given. The correlation function of the random reflections is determined assuming that the scattering objects move as a single unit, their motion being random within the unit, this causing the Doppler effect in the reflected signal. The processing of the information received and the detection of targets moving with different speeds are considered. R.C.Glass

TELEVISION

621.397.132

6973 THEORETICAL DETERMINATION OF THE TRANSMISSION PARAMETERS OF COLOUR-CARRYING INFORMATION. J.Pazderák.

Slaboproudy Obzor, Vol. 21, No. 6, 329-36 (1960). In Czech.

The compatible colour television system with quadrature modulation of the colour-carrying components is considered. It is assumed that the criterion for estimating the quality of the transmission channel for colour-carrying information is the colour transient which appears at the boundary of the colour areas. This is the optical analogue of the electrical transients observed in linear networks. Calculations show that the bandwidth required by the colour-carrying components (E_R-E_Y) and (E_B-E_Y) is 2.8 Mc/s at 6 dB down in the case of a standard colour transient with 1 : 1 brightness ratio; the bandwidth for the transients with equal contributions of the brightness ratios of 1 : 1, 1 : 2 and 1 : 4 is 1.9 Mc/s at 6 dB. The permissible theoretically calculated overshoot is 5%. R.S.Sidorowicz

621.397.132

6974 INFLUENCE OF PHASE DEVIATIONS FROM EXACT QUADRATURE MODULATION ON THE COLOUR DISTORTION OF LARGE PICTURE AREAS. M.Ptáček.

Slaboproudy Obzor, Vol. 21, No. 6, 336-40 (1960). In Czech.

The effect of the phase deviation of the electrical modulation axes of the colour-carrying components E_R-E_Y and E_B-E_Y from the exact 90° angle on the distortion of large picture areas is investigated analytically. It is found that the regions of highest distortion correspond to hues lying on the colorimetric axes (R'-Y') and (B'-Y'), and that they are dependent on a single colour-carrying component. Permissible deviation in the position of the modulation axes is ±5° (for the whole transmission system) and it is identical for both axes. The above investigation forms a part of a wider research programme aiming at determining the transmission parameters in colour television in accordance with standards laid down by the O.I.R.T. R.S.Sidorowicz

621.397.2

6975 SEQUENTIAL RECEIVERS FOR FRENCH COLOR TV SYSTEM. R.Chaste, P.Cassagne and M.Colas.
Electronics, Vol. 33, No. 19, 57-60 (May 6, 1960).

The transmitter radiates the luminance signal as modulation of main carrier. It radiates the R and the B chrominance signals as modulation of a 4.43 Mc/s sub-carrier during each alternate picture line and finally a chrominance-identifying sub-carrier burst. In the receiver the chrominance signal passes into two channels, one of which incorporates a 1-line delay transducer. The two signals pass to a changeover switch which is actuated by the chrominance-identifying signal. Accordingly full chrominance is applied to the colour kinescope all the time although one of the two components is associated with the previous line. The delay transducer is made up of piezo-electric wafers of barium titanate. H.G.M.Spratt

621.397.23

6976 A THEORETICAL CONTRIBUTION TO THE PROBLEM OF THE OPTIMAL SHAPE OF THE NYQUIST FLANK IN TELEVISION. K.Bernath.
Tech. Mitt. P.T.T., Vol. 38, No. 4, 113-17 (1960). In German and French.

A brief treatment of the transient response of single-sideband transmission problems, using Bode's analytical method. Amplitude and phase delay characteristics are plotted for British, American, O.I.R. and C.C.I.R. standards, the latter for Nyquist flanks of ±0.75, ±1.125 and ±1.5 Mc/s width. A bibliography of 27 items is appended. A.Landman

621.397.331.2

6977 THE BONDED SHIELD PICTURE TUBE. L.W.Evans.
Sylvania Technol, Vol. 13, No. 2, 52-4 (April, 1960).

Describes the design, manufacture and advantages of a television picture tube with a safety glass cemented or laminated directly on the face of the tube.

621.397.331.24

6978 SINGLE-GUN VERSUS THREE-GUN TUBES: THEIR INFLUENCE ON COLOUR RECEIVER DESIGN. R.N.Jackson.
J. Televis. Soc., Vol. 9, No. 6, 207-22 (April-June, 1960).

Presents a fundamental approach to the one-gun versus three-gun tube controversy, viewing the problem from consideration of the inherent factors involved in the two systems, rather than dealing with particular known tube types. Fundamental problems and advantages of three-gun and one-gun tubes are discussed and an outline is given of circuit requirements and the expected picture quality. A comparison is made between the situation as seen from the theoretical viewpoint taken by the paper and the situation as seen in current practice.

621.397.61

6979 A VERTICAL APERTURE EQUALIZER FOR TELEVISION. W.G.Gibson and A.C.Schroeder.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 6, 395-401 (June, 1960).

A vertical aperture equalizer employing delays of one scanning line was built and used on commercial broadcasts to increase the subjective sharpness of television pictures. By using both vertical and horizontal aperture equalization, optical aperture defects can be corrected. By the use of vertical aperture equalization and scanning apertures with suitable responses, television in the future may be practically free of line structure and spurious pattern effects due to the scanning-line structure.

621.397.61

6980 THE PERFORMANCE OF TELEVISION CAMERA LENSES. G.H.Cook.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 6, 406-10 (June, 1960).

621.397.61

6981 TRANSMITTER NETWORKS WITH NONLINEAR CHANNEL DISTRIBUTIONS. F.Maarleveld.
Rdfunktech. Mitt., Vol. 4, No. 2, 57-9 (April, 1960). In German.

In the planning of television transmitter networks for bands IV and V, a linear channel distribution is usually adopted. For theoretical networks with a given geometry of the elementary and common-channel triangles, a method of obtaining favourable solutions is described. For certain channel numbers, there are distributions which allow for equilateral elementary as well as equilateral common-channel triangles. This is illustrated by three examples. The comparison carried out between linear and non-linear channel distributions does not permit of a general conclusion as to the superiority of the one or the other. It thus seems desirable to consider both distributions in planning a practical transmitter network. A.Wilkinson

621.397.61

6982 APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. I.
K.Hiwatashi, Y.Fujimura, K.Suzuki and N.Mii.
Semiconductor Prod., Vol. 3, No. 5, 45-9 (May, 1960).

Describes developments in the transistorization of television transmitting equipment in Japan. Block and schematic diagrams are given of a portable camera–transmitter unit using 120 transistors and weighing 18 kg. Operating frequency is 2 Gc/s and power consumption is 36 W. The 1-inch vidicon camera has a resolution of 400 lines.

621.397.61

6983 APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. II.
K.Hiwatashi, Y.Fujimura, K.Suzuki and N.Mii.
Semiconductor Prod., Vol. 3, No. 6, 44-8 (June, 1960).

A block diagram is given of a sync. signal generator for use with camera transmitter described in the preceding abstract.

621.397.62 : 621.396.62

TRANSISTORIZED TELEVISION TUNERS USING MESA AND M.A.D. TYPES. See Abstr. 6916

621.397.61

6984 APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. III.
K.Hiwatashi, Y.Fujimura, K.Suzuki and N.Mii.
Semiconductor Prod., Vol. 3, No. 7, 26-8 (July, 1960).

This part describes the head amplifier, horizontal-deflection circuit and power-supply units for a portable image-orthicon camera.

621.397.621

6985 OPERATIONAL FACILITIES IN THE R.C.A. COLOUR TELEVISION TAPE RECORDER. A.H.Lind.
J. Brit. Instn Radio Engrs, Vol. 20, No. 8, 611-19 (Aug., 1960).

The design of the recorder makes many new operating facilities available as integrated parts of the recorder. The electrical delay adjustments are intended to make greater precision readily available and facilitate tape interchangeability. A detailed account is given of the manner of making the adjustments to reduce quadrature errors at the heads.

621.397.621

6986 SLOW-MOTION RECORDER FOR TELEVISION PICTURES. H.Hiwatashi, E.Mio and T.Kitagawa.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 4, 261-3 (April, 1960).

An arrangement with a standard camera was devised to televise sporting events having fast action and to broadcast these in slow motion, with very little delay. Successive fields, at 60 per sec, are recorded as separate frames on 16mm film which is developed in a rapid processor, then broadcast as standard film. The speed ratio is 2.5 : 1, and the delay 1.5 min. A film storage allows 14 min of showing time (5.6 min original scene time).

621.397.621

6987 NEW PROPOSALS FOR AUTOMATIC GAIN CONTROL [IN TELEVISION RECEIVERS]. P.L.Mothersole.
Mullard tech. Commun., Vol. 5, 82-8 [April, 1960].

The operation of a conventional mean-level a.g.c. circuit is examined as an introduction to techniques for improving its performance. Two improved circuits are described in detail. One is a simple amplified circuit, the amplifier being operated from the frame timebase. The other is a nonamplified system that uses the peak amplitude of the video signal for a control potential. The circuits are capable of producing a relatively high control potential, thus enabling a wide range of automatic control to be achieved without resorting to auxiliary manual controls. The circuits do not use many additional components and are not critical with respect to valve or component characteristics.

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-52

6988 A CLOSED LOOP DATA FITTING PROBLEM. R.A.Woodrow.
J. Electronics and Control, Vol. 8, No. 2, 149-60 (Feb., 1960).

Study of data collected from a linear, passive, time-invariant, closed loop reveals that the linear dependence of the control variable upon the input variable makes data collected from such a system unsuitable for the determination of its dynamics. It is shown that the introduction of a disturbance into the loop can destroy the linear dependence, but special care may still be necessary for the determination of the dynamics from the data. It emerges that: (a) to seek a linear, passive, time-invariant operator, to approximate the active elements containing the disturbance, leads to a physically valueless solution of the optimization problem, while (b) the insertion of the disturbance into the loop at a point external to the element studied or (c) the choice of an optimum operator from a linear, active, time-invariant sub-class, makes a physically meaningful solution of the optimization problem possible.

621-52 : 621.372.5

OPTIMUM ESTIMATION OF IMPULSE RESPONSE IN THE PRESENCE OF NOISE. See Abstr. 6156

621-52

6989 NONLINEAR COMPENSATOR FOR A PIECEWISE LINEAR SECOND-ORDER FEEDBACK SYSTEM. M.Athanassiades and O.J.M.Smith.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 167-73 (1960) = Applic. and Industr., Vol. 49, (July, 1960).

The nonlinear computer for a second-order system preceded by a saturating amplifier, with significant linear zone, was designed through the transformation of the zero-force curve and the geometry of the phase plane into the topology of the nonlinear computer. A finite-gain system was thus designed for the requirement of minimum settling time for step input functions. The method of design is based upon the division of the phase plane into three regions of operation: a saturated one, and two linear ones. The equation of the zero-force curve is that of a parabola. The nonlinear compensator has its output the sum of the error signal and a nonlinear function of the error rate. Different systems are compared in order to determine the fastest one. One of them proves to be superior to all the others for a spectrum of different input step magnitudes.

621-52

6990 PHASE-ANGLE MEASUREMENT IN CONTROL SYSTEMS. S.J.Goldwater.
Trans Soc. Instrum. Technol., Vol. 12, No. 2, 100-5 (June, 1960).

Five basic techniques of phase-angle measurement used in process control, servomechanisms and component-testing are discussed and the accuracy to be expected from them is indicated. Some practical applications are described.

621-52

6991 AN APPROACH TO DYNAMIC OPTIMIZING CONTROL OF THE CONTINUOUS PROCESS. J.F.Sandelien.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 291-9 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Optimum performance of the multivariable continuous process under transient conditions is considered. A generalized performance criterion is formulated in terms of the cost of operation. Assuming that the essential process behaviour is known and that the major disturbance variables may be measured, the necessary conditions for minimum cost of operation are derived by applying calculus of variations in conjunction with the Lagrange multipliers technique. In certain typical cases of process behaviour and cost criteria, the resulting necessary conditions reduce to a form which will yield an analytical solution. In particular, by certain approximations of the system behaviour in the vicinity of an operating point, the necessary condition for optimum performance is expressed in terms of an inhomogeneous Wiener–Hopf integral equation of the second kind and the solution is obtained by spectral factorization. In general, the conditions to be satisfied for minimum cost of operation appear as a set of nonlinear integral equations. A method for handling the general case is suggested.

621-52 : 621.396.96

6992 THE DYNAMIC PROPERTIES OF RANGE-TRACKING LOOPS WITH TWO INTEGRATORS. A.G.Saibel' and E.P.Nikitin.
Radiotekhnika, Vol. 15, No. 3, 25-30 (March, 1960). In Russian.

The conditions under which the loop is stable are first derived. The subsequent analysis of the control action differs from those previously published in that the discrete nature of the control action is taken into account. A constant-speed target is assumed and it is shown that the effective memory of the system depends on the time-constant of the second integrator. S.C.Dunn

621-52

6993 PHASE SPACE IN THE THEORY OF OPTIMUM CONTROL. A.T.Fuller.
J. Electronics and Control, Vol. 8, No. 5, 381-400 (May, 1960).

Phase space is an essential concept in the theory of optimum non-linear control, but has been given only cursory exposition hitherto. This paper attempts to bridge the gap between the control engineer who uses phase space heuristically and the mathematician who adopts phase space as an arbitrary starting point. A history of the phase-space concept is given. It is shown how to define and measure the phase coordinates of linear and non-linear systems. A special treatment of electrical networks is given.

621-52

6994 CONCERNING THE SYNTHESIS OF THE OPTIMUM NON-LINEAR CONTROL SYSTEMS. R.Kulikowski.
Bull. Acad. Polon, Sci. Ser. Sci. tech., Vol. 7, No. 6, 391-9 (1959).

621-52

6995 THE PROBABILITY OF BREAKDOWN OF AUTOMATIC CONTROL SYSTEM ELEMENTS. S.M.Kuznetsov.
Avtomat. i Telemekh., Vol. 19, No. 11, 1048-61 (1958). In Russian.

Points out the need for an analytic approach on account of the crudity of existing experimental methods of assessing breakdown probability. The operation of the element (thermionic tube, capacitor, etc.) is assumed to depend on several independent parameters, having certain tolerances. The probability of failure of the element with respect to all its parameters can be written approximately as the sum of the probabilities of failure with respect to each individual parameter. The variation of a parameter is considered as a function of disturbances in manufacture and operation of the element. The resultant deviations of the parameters due to random disturbances are considered and an expression is obtained for the probable life of an element with respect to a given parameter. The relationship is deduced between the element failure distribution law and the disturbing factors, in a form suitable for practical assessments. [English summary: PB 141096T-12, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. D.E.Brown

621-52

6996 A NEW DAMPING CRITERION. P.Naslin.
Automatisme, Vol. 5, No. 6, 229-36 (June, 1960). In French.

A requirement for stability of a control loop is that the gain curve shall increase regularly. An approximate curve can be constructed from the terms of the characteristic equation, that is, by a series of straight lines with slopes equal to the power of p. This method does not offer a parameter that can be adjusted for optimum damping of transients. A new class of polynomials is defined, for which the frequencies corresponding to the successive angular points of the approximate curve are in a constant ratio α. Corresponding ratios of the coefficients can be set equal to α, which is chosen for the desired degree of damping, and for most applications will be between 1.5 and 2.5. The resulting equations are more likely to be soluble than those derived from other classes of polynomials, and allow the system parameters to be chosen to meet the criterion. Responses to a step function are given for various of α, and the method is applied to typical problems. W.G.Stripp

621-52 : 621.383

6997 INFRARED DETECTOR CONTROLS AUTOMOBILE BRAKES. W.E.Osborne.
Electronics, Vol. 32, No. 42, 86 (Oct. 16, 1959).

An indium antimonide cell responds to radiation from vehicles

621.397.2

6975 SEQUENTIAL RECEIVERS FOR FRENCH COLOR TV SYSTEM. R.Chaste, P.Cassagne and M.Colas.
Electronics, Vol. 33, No. 19, 57-60 (May 6, 1960).

The transmitter radiates the luminance signal as modulation of main carrier. It radiates the R and the B chrominance signals as modulation of a 4.43 Mc/s sub-carrier during each alternate picture line and finally a chrominance-identifying sub-carrier burst. In the receiver the chrominance signal passes into two channels, one of which incorporates a 1-line delay transducer. The two signals pass to a changeover switch which is actuated by the chrominance-identifying signal. Accordingly full chrominance is applied to the colour kinescope all the time although one of the two components is associated with the previous line. The delay transducer is made up of piezo-electric wafers of barium titanate.

H.G.M.Spratt

621.397.23

6976 A THEORETICAL CONTRIBUTION TO THE PROBLEM OF THE OPTIMAL SHAPE OF THE NYQUIST FLANK IN TELEVISION. K.Bernath.
Tech. Mitt. P.T.T., Vol. 38, No. 4, 113-17 (1960). In German and French.

A brief treatment of the transient response of single-sideband transmission problems, using Bode's analytical method. Amplitude and phase delay characteristics are plotted for British, American, O.I.R. and C.C.I.R. standards, the latter for Nyquist flanks of ±0.75, ±1.125 and ±1.5 Mc/s width. A bibliography of 27 items is appended.

A.Landman

621.397.331.2

6977 THE BONDED SHIELD PICTURE TUBE. L.W.Evans.
Sylvania Technol, Vol. 13, No. 2, 52-4 (April, 1960).

Describes the design, manufacture and advantages of a television picture tube with a safety glass cemented or laminated directly on the face of the tube.

621.397.331.24

6978 SINGLE-GUN VERSUS THREE-GUN TUBES: THEIR INFLUENCE ON COLOUR RECEIVER DESIGN. R.N.Jackson.
J. Televis. Soc., Vol. 9, No. 6, 207-22 (April-June, 1960).

Presents a fundamental approach to the one-gun versus three-gun tube controversy, viewing the problem from consideration of the inherent factors involved in the two systems, rather than dealing with particular known tube types. Fundamental problems and advantages of three-gun and one-gun tubes are discussed and an outline is given of circuit requirements and the expected picture quality. A comparison is made between the situation as seen from the theoretical viewpoint taken by the paper and the situation as seen in current practice.

621.397.61

6979 A VERTICAL APERTURE EQUALIZER FOR TELEVISION. W.G.Gibson and A.C.Schroeder.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 6, 395-401 (June, 1960).

A vertical aperture equalizer employing delays of one scanning line was built and used on commercial broadcasts to increase the subjective sharpness of television pictures. By using both vertical and horizontal aperture equalization, optical aperture defects can be corrected. By the use of vertical aperture equalization and scanning apertures with suitable responses, television in the future may be practically free of line structure and spurious pattern effects due to the scanning-line structure.

621.397.61

6980 THE PERFORMANCE OF TELEVISION CAMERA LENSES. G.H.Cook.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 6, 406-10 (June, 1960).

621.397.61

6981 TRANSMITTER NETWORKS WITH NONLINEAR CHANNEL DISTRIBUTIONS. F.Maarleveld.
Rdfunktech. Mitt., Vol. 4, No. 2, 57-9 (April, 1960). In German.

In the planning of television transmitter networks for bands IV and V, a linear channel distribution is usually adopted. For theoretical networks with a given geometry of the elementary and common-channel triangles, a method of obtaining favourable solutions is described. For certain channel numbers, there are distributions which allow for equilateral elementary as well as equilateral common-channel triangles. This is illustrated by three examples. The comparison carried out between linear and non-linear channel distributions does not permit of a general conclusion as to the superiority of the one or the other. It thus seems desirable to consider both distributions in planning a practical transmitter network.

A.Wilkinson

621.397.61

6982 APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. I.
K.Hiwatashi, Y.Fujimura, K.Suzuki and N.Mii.
Semiconductor Prod., Vol. 3, No. 5, 45-9 (May, 1960).

Describes developments in the transistorization of television transmitting equipment in Japan. Block and schematic diagrams are given of a portable camera–transmitter unit using 120 transistors and weighing 18 kg. Operating frequency is 2 Gc/s and power consumption is 36 W. The 1-inch vidicon camera has a resolution of 400 lines.

621.397.61

6983 APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. II.
K.Hiwatashi, Y.Fujimura, K.Suzuki and N.Mii.
Semiconductor Prod., Vol. 3, No. 6, 44-8 (June, 1960).

A block diagram is given of a sync. signal generator for use with camera transmitter described in the preceding abstract.

621.397.62 : 621.396.62

TRANSISTORIZED TELEVISION TUNERS USING MESA AND M.A.D. TYPES. See Abstr. 6916

621.397.61

6984 APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. III.
K.Hiwatashi, Y.Fujimura, K.Suzuki and N.Mii.
Semiconductor Prod., Vol. 3, No. 7, 26-8 (July, 1960).

This part describes the head amplifier, horizontal-deflection circuit and power-supply units for a portable image-orthicon camera.

621.397.621

6985 OPERATIONAL FACILITIES IN THE R.C.A. COLOUR TELEVISION TAPE RECORDER. A.H.Lind.
J. Brit. Instn Radio Engrs, Vol. 20, No. 8, 611-19 (Aug., 1960).

The design of the recorder makes many new operating facilities available as integrated parts of the recorder. The electrical delay adjustments are intended to make greater precision readily available and facilitate tape interchangeability. A detailed account is given of the manner of making the adjustments to reduce quadrature errors at the heads.

621.397.621

6986 SLOW-MOTION RECORDER FOR TELEVISION PICTURES. H.Hiwatashi, E.Mio and T.Kitagawa.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 4, 261-3 (April, 1960).

An arrangement with a standard camera was devised to televise sporting events having fast action and to broadcast these in slow-motion, with very little delay. Successive fields, at 60 per sec, are recorded as separate frames on 16mm film which is developed in a rapid processor, then broadcast as standard film. The speed ratio is 2.5 : 1, and the delay 1.5 min. A film storage allows 14 min of showing time (5.6 min original scene time).

621.397.621

6987 NEW PROPOSALS FOR AUTOMATIC GAIN CONTROL [IN TELEVISION RECEIVERS]. P.L.Mothersole.
Mullard tech. Commun., Vol. 5, 82-8 [April, 1960].

The operation of a conventional mean-level a.g.c. circuit is examined as an introduction to techniques for improving its performance. Two improved circuits are described in detail. One is a simple amplified circuit, the amplifier being operated from the frame timebase. The other is a nonamplified system that uses the peak amplitude of the video signal for a control potential. The circuits are capable of producing a relatively high control potential, thus enabling a wide range of automatic control to be achieved without resorting to auxiliary manual controls. The circuits do not use many additional components and are not critical with respect to valve or component characteristics.

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-52

6988 A CLOSED LOOP DATA FITTING PROBLEM. R.A.Woodrow.

J. Electronics and Control, Vol. 8, No. 2, 149-60 (Feb., 1960).

Study of data collected from a linear, passive, time-invariant, closed loop reveals that the linear dependence of the control variable upon the input variable makes data collected from such a system unsuitable for the determination of its dynamics. It is shown that the introduction of a disturbance into the loop can destroy the linear dependence, but special care may still be necessary for the determination of the dynamics from the data. It emerges that: (a) to seek a linear, passive, time-invariant operator, to approximate the active elements containing the disturbance, leads to a physically valueless solution of the optimization problem, while (b) the insertion of the disturbance into the loop at a point external to the element studied or (c) the choice of an optimum operator from a linear, active, time-invariant sub-class, makes a physically meaningful solution of the optimization problem possible.

621-52 : 621.372.5

OPTIMUM ESTIMATION OF IMPULSE RESPONSE IN THE PRESENCE OF NOISE. See Abstr. 6156

621-52

6989 NONLINEAR COMPENSATOR FOR A PIECEWISE LINEAR SECOND-ORDER FEEDBACK SYSTEM. M.Athanassiades and O.J.M.Smith.

Trans Amer. Inst. Elect. Engrs II, Vol. 79, 167-73 (1960) = Applic. and Industr., Vol. 49, (July, 1960).

The nonlinear computer for a second-order system preceded by a saturating amplifier, with significant linear zone, was designed through the transformation of the zero-force curve and the geometry of the phase plane into the topology of the nonlinear computer. A finite-gain system was thus designed for the requirement of minimum settling time for step input functions. The method of design is based upon the division of the phase plane into three regions of operation: a saturated one, and two linear ones. The equation of the zero-force curve is that of a parabola. The nonlinear compensator has its output the sum of the error signal and a nonlinear function of the error rate. Different systems are compared in order to determine the fastest one. One of them proves to be superior to all the others for a spectrum of different input step magnitudes.

621-52

6990 PHASE-ANGLE MEASUREMENT IN CONTROL SYSTEMS. S.J.Goldwater.

Trans Soc. Instrum. Technol., Vol. 12, No. 2, 100-5 (June, 1960).

Five basic techniques of phase-angle measurement used in process control, servomechanisms and component-testing are discussed and the accuracy to be expected from them is indicated. Some practical applications are described.

621-52

6991 AN APPROACH TO DYNAMIC OPTIMIZING CONTROL OF THE CONTINUOUS PROCESS. J.F.Sandelien.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 291-9 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Optimum performance of the multivariable continuous process under transient conditions is considered. A generalized performance criterion is formulated in terms of the cost of operation. Assuming that the essential process behaviour is known and that the major disturbance variables may be measured, the necessary conditions for minimum cost of operation are derived by applying calculus of variations in conjunction with the Lagrange multipliers technique. In certain typical cases of process behaviour and cost criteria, the resulting necessary conditions reduce to a form which will yield an analytical solution. In particular, by certain approximations of the system behaviour in the vicinity of an operating point, the necessary condition for optimum performance is expressed in terms of an inhomogeneous Wiener–Hopf integral equation of the second kind and the solution is obtained by spectral factorization. In general, the conditions to be satisfied for minimum cost of operation appear as a set of nonlinear integral equations. A method for handling the general case is suggested.

621-52 : 621.396.96

6992 THE DYNAMIC PROPERTIES C ? RANGE-TRACKING LOOPS WITH TWO INTEGRATORS. A.G.Saibel' and E.P.Nikitin.

Radiotekhnika, Vol. 15, No. 3, 25-30 (March, 1960). In Russian.

The conditions under which the loop is stable are first derived. The subsequent analysis of the control action differs from those previously published in that the discrete nature of the control action is taken into account. A constant-speed target is assumed and it is shown that the effective memory of the system depends on the time-constant of the second integrator. S.C.Dunn

621-52

6993 PHASE SPACE IN THE THEORY OF OPTIMUM CONTROL. A.T.Fuller.

J. Electronics and Control, Vol. 8, No. 5, 381-400 (May, 1960).

Phase space is an essential concept in the theory of optimum non-linear control, but has been given only cursory exposition hitherto. This paper attempts to bridge the gap between the control engineer who uses phase space heuristically and the mathematician who adopts phase space as an arbitrary starting point. A history of the phase-space concept is given. It is shown how to define and measure the phase coordinates of linear and non-linear systems. A special treatment of electrical networks is given.

621-52

6994 CONCERNING THE SYNTHESIS OF THE OPTIMUM NON-LINEAR CONTROL SYSTEMS. R.Kulikowski.

Bull. Acad. Polon, Sci. Ser. Sci. tech., Vol. 7, No. 6, 391-9 (1959).

621-52

6995 THE PROBABILITY OF BREAKDOWN OF AUTOMATIC CONTROL SYSTEM ELEMENTS. S.M.Kuznetsov.

Avtomat. i Telemekh., Vol. 19, No. 11, 1048-61 (1958). In Russian.

Points out the need for an analytic approach on account of the crudity of existing experimental methods of assessing breakdown probability. The operation of the element (thermionic tube, capacitor, etc.) is assumed to depend on several independent parameters, having certain tolerances. The probability of failure of the element with respect to all its parameters can be written approximately as the sum of the probabilities of failure with respect to each individual parameter. The variation of a parameter is considered as a function of disturbances in manufacture and operation of the element. The resultant deviations of the parameters due to random disturbances are considered and an expression is obtained for the probable life of an element with respect to a given parameter. The relationship is deduced between the element failure distribution law and the disturbing factors, in a form suitable for practical assessments. [English summary: PB 141096T-12, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. D.E.Brown

621-52

6996 A NEW DAMPING CRITERION. P.Naslin.

Automatisme, Vol. 5, No. 6, 229-36 (June, 1960). In French.

A requirement for stability of a control loop is that the gain curve shall increase regularly. An approximate curve can be constructed from the terms of the characteristic equation, that is, by a series of straight lines with slopes equal to the power of p. This method does not offer a parameter that can be adjusted for optimum damping of transients. A new class of polynomials is defined, for which the frequencies corresponding to the successive angular points of the approximate curve are in a constant ratio α. Corresponding ratios of the coefficients can be set equal to α, which is chosen for the desired degree of damping, and for most applications will be between 1.5 and 2.5. The resulting equations are more likely to be soluble than those derived from other classes of polynomials, and allow the system parameters to be chosen to meet the criterion. Responses to a step function are given for various of α, and the method is applied to typical problems. W.G.Stripp

621-52 : 621.383

6997 INFRARED DETECTOR CONTROLS AUTOMOBILE BRAKES. W.E.Osborne.

Electronics, Vol. 32, No. 42, 86 (Oct. 16, 1959).

An indium antimonide cell responds to radiation from vehicles

ahead of a car, the radiation being focused on to the cell by means of an optical system mounted under the front bumper. Voltage derived from the cell is used to apply the brakes. D.E.Rae

621-52

6998 THE TEACHING MACHINE AS A CONTROL MECHANISM. G.Pask.
Trans Soc. Instrum. Technol., Vol. 12, No. 2, 72-89 (June, 1960).

The theory and operation of a typical teaching machine is discussed. Ideally this would take the place of a private instructor who presented exercises, marked them, and gave critical advice. In practice, most instructors are unable to give their undivided attention for more than short periods at a time, whereas the teaching machine is capable of continuous presentation, monitoring, and criticism of the trainee's performance. Exercises are presented to the pupil in increasing order of difficulty and complexity; but the teaching machine will not permit him to progress to the next exercise unless he has reached a certain agreed standard of proficiency in speed and accuracy in the previous set. Learning a skill should be no different from playing a partly competitive, partly cooperative game. The result of playing the game is to keep the interest and attention of the trainee, and, in some respects, to help him find the method which allows him, as an individual, to play the game optimally. The teaching machine is shown to be sufficiently flexible in operation to modify its training routine to suit the individual trainee.

621-52

6999 A NOTE ON THE CONVERGENCE OF A PROCEDURE FOR THE NUMERICAL CALCULATION OF TRANSIENT STATES. J.Charles.
Rev. A, Vol. 2, No. 1, 16-23 (Jan., 1960). In French.

Establishes a convergence theorem for the iterative procedure used by P.Naslin [Rev. A, No. 5, (1959)] for the determination of the response of the system whose behaviour can be described by an n^{th} order differential system. G.D.Sims

621-526

7000 QUICK NEW METHOD GIVES SYSTEM TIME CONSTANTS. H.K.Chatterjee.
Control Engng, Vol. 7, No. 7, 97 (July, 1960).

A specific simple solution for the two time-constants of a closed-loop position-servo using a field-controlled d.c. motor is given.

621-526

7001 USE OF THERMISTORS FOR ERROR INTEGRATION IN CARRIER TYPE SERVOMECHANISMS. A.Solbakken.
Instrum. Pract., Vol. 11, No. 6, 640-6 (June, 1960).

Presents a simple method of introducing integral error compensation in carrier type servomechanisms. The error signal is fed to separate proportional and integral channels, where two indirectly heated thermistors are used in the integral channel to perform demodulation, desired integration and modulation. A maximum range of integration of 20 dB has been achieved, and the location may be shifted over one decade by a special feedback circuit.

621-526

7002 STABILIZATION OF CONTACTOR SERVOS BY USING COULOMB FRICTION. A.K.Mahalanabis.
J. Electronics and Control, Vol. 8, No. 4, 307-19 (April, 1960).

Gives results of investigations to consider the possibility of utilizing Coulomb friction present in relay servo systems for the purpose of improving their small-signal stability. Discussions are presented on the basis of describing-function results. Data obtained with the help of a simulator are also presented as an experimental aid to the understanding of system operation.

621-526

7003 NOISE IN COMPENSATED RECORDERS. H.Frenk.
Regelungstechnik, Vol. 8, No. 4, 126-9 (April, 1960). In German.

A calculation of the frequency response of compensated recorders using the Nyquist and Johnson equations is followed by a discussion of the influence of time-constants at various places in the control loop and the possibility of a decrease of ripple without increase of sluggishness. Some remarks are given regarding an application for infrared spectrographs. J.H.W.Arends

621-526

7004 STABILITY ANALYSIS OF DUAL-MODE SERVOMECHANISMS. J.E.Gibson and E.S.McVey.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 173-8 (1960) = Applic. and Industr., No. 49 (July, 1960).

Dual-mode servomechanisms have several advantages, such as light weight and simplicity, but a serious study of the stability problems encountered in such devices has not appeared in the literature. An analytical method is presented for determining the stability of dual-mode servomechanisms by an extension of the describing-function method of analysis. The method is illustrated with examples, and laboratory data are presented. Analysis by describing functions shows that a dual-mode system may be unstable even though its linear and relay modes of operation are stable as systems by themselves, and the mode-switching circuitry is perfect. It is also shown that for certain mode boundary shapes the describing function is a function of frequency as well as amplitude.

621-526

7005 OPTIMIZATION OF THE ADAPTIVE FUNCTION BY Z-TRANSFORM METHOD. S.S.L.Chang.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 223-31 (1960) = Applic. and Industr., No. 49 (July, 1960).

A study is made on the optimization of the adjustment process in a self-optimizing system under rather general assumptions. The system is designed to keep a performance parameter m either at a prescribed value or at an unknown extremal value. A direct measurement on m is made and the adjustment is based on measured m only. Factors considered are: (1) the finite measuring interval; (2) the necessity of looking ahead one interval; (3) the probable error in measurement; and (4) the changing situation. A set of weighting factors on present and past data, and the proper value of test bias for extremal-seeking systems, are determined by a least square optimization process. The criterion of optimization is least reduction in m for peak-seeking systems and least square error in m for systems with prescribed value of m. Two types of extremal-seeking systems are studied. The alternate biasing systems are found to be superior in performance compared to the derivative sensing systems.

TELECONTROL . TELEMETERING

621.398

7006 ELECTRONIC EQUIPMENT FOR IN-FLIGHT PROCESSING OF ROCKET-BORNE MASS SPECTROMETER DATA. J.H.Wager.
J. Electronics and Control, Vol. 8, No. 3, 227-40 (March, 1960).

A data sampling technique is employed in order that the high-frequency signals obtained from a time-of-flight mass spectrometer may be transmitted over a narrow-band telemetry link. By comparing the instantaneous amplitude of two sawtooth waveforms, a strobing pulse is obtained which scans the high-frequency signal after amplification. By feeding the output of the strobing circuit to a low-pass filter a slow-speed version of the original signal is formed. A simple transistor pulser to produce fast pulses in a capacitive load is also described.

621.398 : 621.316.925

7007 CARRIER TRANSMISSION OF SELECTIVE PROTECTION SIGNALS IN HIGH-VOLTAGE NETWORKS. R.Bartsch and G.Bergmann.
Siemens-Z., Vol. 34, No. 7, 422-7 (July, 1960). In German.

A description of the operating principle of selective protection systems is followed by an explanation of instances where carrier equipment can be used to advantage. The principle features of such equipment are described. A distinction is made between single-purpose and multi-purpose equipment, which latter may be designed for simultaneous or individual operation. To illustrate how to choose the most suitable type of equipment for a given instance, explanations are furnished as to why this or that type of equipment was chosen in practice.

621.398

7008 ON THE SELECTIVITY OF RECTIFIER MEASURING DEVICES. K.B.Karandeev and L.A.Sinitskii.
Avtomat. i Telemekh., Vol. 19, No. 9, 892-5 (1958). In Russian.

Spurious components of control signals introduce errors into

measurements. The effect of noise is mitigated by rectification. The magnitude of error depends on the signal-noise-ratio and rectifier configuration. Phase-shift discriminating circuits with rectangular wave input render error negligible. A bibliography is added. [English summary: PB 141096T-8, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C.].
P.Szekely

COMPUTERS . APPLICATIONS

(Refer also to Digital circuits . Switching circuits)

681.142

7009 SOME REFLECTIONS ON DIGITAL COMPUTER DESIGN. W.Renwick.

J. Brit. Instn Radio Engrs, Vol. 20, No. 8, 563-72 (Aug., 1960).

The factors influencing computing machine development, during the past decade, are reviewed from the point of view of the circuit engineer. The effect of new components such as the transistor and rectangular-loop ferrite core and of the introduction of new techniques of manufacture are considered. The reduction of the influence of the circuit engineer in computer design is forecast, due to the trend towards packaged construction and the introduction of novel concepts in design.

681.142

7010 THE MATHEMATICAL MODEL APPROACH TO COMPUTER CONTROL. D.B.Brandon.

I.R.E. Trans Industr. Electronics, Vol. IE-7, No. 1, 15-20 (March, 1960).

Two quite different bases for establishing an on-line computer control system for a manufacturing process have been described in the literature. These are the "exploratory" or "teleological" approach and the "predictive" approach employing a mathematical model of the process. Both methods, when applicable to a particular plant installation, lead to considerably improved process control. In an effort to clarify the kind of situation in which predictive control is to be preferred, the major criteria are presented and described in general terms. Emphasis is placed on the requirements of plants in the chemical, petrochemical, petroleum and similar industries. The elements of a predictive control system for a chemical-type plant are outlined.

681.142

7011 A NOTE ON THE APPLICATION OF GRAPH THEORY TO DIGITAL COMPUTER PROGRAMMING. R.M.Karp.

Information and Control, Vol. 3, No. 2, 179-90 (June, 1960).

A graph–theoretic model for the description of flowcharts and programmes is defined. It is shown that properties of directed graphs and the associated connection matrices can be used to detect errors and eliminate redundancies in programmes. These properties are also used in the synthesis of composite programmes. Finally, the model is expanded to take into account frequencies of execution of portions of a programme, and a problem concerning optimum arrangement of a programme in storage is solved.

681.142

7012 AN INTRODUCTION TO THE TERNARY CODE NUMBER SYSTEM. D.J.Morris and W.Alexander.

Electronic Engng, Vol. 32, 554-7 (Sept., 1960).

681.142

7013 THE PROPERTIES AND METHODS FOR COMPUTATION OF EXPONENTIALLY-MAPPED-PAST STATISTICAL VARIABLES. J.Otterman.

I.R.E. Trans Automatic Control, Vol. AC-5, No. 1, 11-7 (Jan., 1960).

The exponentially-mapped-past (e.m.p.) statistical variables represent an approach to the statistical analysis of a process when the interest is focused on the recent behaviour of the process. An exponential weighting function, decreasing into the past, in the case of continuously observed processes, and a geometric ratio, in the case of discrete data, are utilized. This approach is the simplest from the point of view of ease of computation, and at the same time it possesses the advantage of some simple theoretical relationships, which are discussed. Analogue computer circuits and digital computer flow diagrams which serve to compute the exponentially-mapped-past statistical variables are presented.

681.142

7014 THE OPTIMAL ORGANIZATION OF SERIAL MEMORY TRANSFERS. A.Gill.

I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 12-15 (March, 1960).

Deals with optimal compilation of programmes whose function is to transfer words of information from one location in a serial memory to another. The most important optimization tool is the "timing schedule", which facilitates the analysis of various transfer schemes and the determination of the fastest one. The procedure described for optimizing serial transfers is readily programmable for computer execution, and is directly applicable to a general class of transportation problems.

681.142

7015 OPTIMIZATION OF REFERENCE SIGNALS FOR CHARACTER RECOGNITION SYSTEMS.

I.Flores and L.Grey.

I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 54-61 (March, 1960).

The role of signal structure in a signal discrimination system is discussed. The optimality criterion for reference signals for detection in the case of white Gaussian independent noise is defined. The need for normalization of the reference signals is demonstrated. A geometric interpretation is presented. Optimum classes are obtained and several examples cited. A theoretical optimum class of signals is derived against which any set of signals developed within given constraints may be rated.

681.142

7016 A CHARACTER-RECOGNITION STUDY. W.E.Dickinson.

I.B.M. J. Res. Developm., Vol. 4, No. 3, 335-48 (July, 1960).

A study of the single-gap-scan approach to character recognition, using an I.B.M. 650 for simulation, is reported. Ten specially designed digits were used. Character recognition is discussed in terms of some simple concepts from n-dimensional geometry. The main contribution is an effective method for using a computer to aid in the design of the type font. This procedure is a natural development of the vector approach. Experimental results show the sensitivity of the system to phasing. An expression is given for a "quality factor." The relationship of this factor to errors and to ink density is illustrated.

681.142

7017 THE APPLICATION OF "DEUCE" TO A PROBLEM IN AERIAL DESIGN. J.Hewson and E.A.Pacello.

Marconi Rev., Vol. 23, 104-9 (3rd Qtr, 1960).

The performance of a practical aerial may be adversely affected by unavoidable errors in its manufacture. The use of a digital computer to assess the effect on the radiation pattern of a slotted waveguide aerial due to small random errors in the cutting of the slots is described.

681.142

7018 AN APPLICATION OF THE "DEUCE" COMPUTER TO NETWORK DESIGN. D.J.Brockington.

Marconi Rev., Vol. 23, 140-8 (3rd Qtr, 1960).

The design of a network with a prescribed phase characteristic can be accomplished by trial and error, provided the trials can be made, and the errors observed, with sufficient rapidity. A method of design in which the necessary rapidity is attained by a slightly unorthodox use of the DEUCE computer is described. See also following abstract.

681.142

7019 INSERTION-LOSS EQUALIZATION, WITH A DIGITAL COMPUTER. D.J.Hull.

Marconi Rev., Vol. 23, 149-52 (3rd Qtr, 1960).

Deals with one approach to the problem of equalizing the amplitude response of a network which has a prescribed phase-delay characteristic. The insertion loss voltage ratio of such a network is a polynomial in $p = j\Omega$, and the network may then be realised as a constant k configuration ladder filter. Such a polynomial may be produced using the method described by Brockington (see preceding Abstr.) which by manipulation of the zeros in the complex frequency p-plane provides a function whose phase-delay approximates closely to some desired characteristic. The amplitude of such an insertion-loss function is generally unsuitable for use as a filter response, but it is possible in some cases to equalize the response so as to obtain a desirable amplitude over the required frequency range, without changing the phase-delay characteristic.

681.142 : 621.396.933.4

7020 AN ELECTRONIC COMPUTING SYSTEM FOR AIR TRAFFIC CONTROL. C.G.H.Scholten.
Proc. Instn Elect. Engrs, Paper 3240 E, publ. March, 1960 [Symposium of Data Handling and Display Systems for Air Traffic Control] (Vol. 107B, Suppl. 19, 12-17, 32-5).

Republication, with discussion, of the paper already abstracted as Abstr. 3202 of 1960.

681.142

7021 USING COMPUTERS IN ENGINEERING DESIGN. C.Storey.
Engineering (London), Vol. 190, 30-1 (July 1, 1960).

The use of electronic digital computers in simple engineering design problems is illustrated by three particular cases: the calculation of the flow of oil between two pumping stations in a pipeline (the flow of three products at three temperatures with eight pumping stations took three to four minutes instead of two to three man-weeks by hand); the flange design for a pressure vessel according to B.S.1500:1959 (two to three minutes); an orifice plate design according to B.S.1042:1943 (four minutes). G.A.Montgomerie

681.142

7022 SYMBOLIC ANALYSIS OF A DECOMPOSITION OF INFORMATION PROCESSING MACHINES. J.Hartmanis.
Information and Control, Vol. 3, No. 2, 154-78 (June, 1960).

The problem of replacing (decomposing) a complex finite state sequential machine by several simpler ones which operate in parallel and yield the same result is studied. The necessary mathematical background and results are given. These results are applied and the necessary and sufficient conditions for the existence of a decomposition for a given machine are derived. If a decomposition exists then the required simpler machines which have to be connected in parallel are given.

681.142

7023 A MOBILE GENERAL-PURPOSE DATA-PROCESSING SYSTEM. C.Pilnick.
I.R.E. Trans Instrumentation, Vol. I-9, No. 1, 35-9 (June, 1960).

A mobile data processing system, suitable either for expansion of existing telemetry data reduction facilities or as an independent data processor at remote test areas is described. The equipment is mounted in a fourty-foot, air-conditioned van, and includes facilities for acquiring data from a wide variety of transducers, conditioning and normalizing signals, recording in both analogue and digital form, processing selected channels for entry into an I.B.M. 704 computer, data editing and tabular printout. The system will accept inputs as low as one millivolt full-scale, and is designed for use with a maximum of 216 input data channels. Recording instrumentation media include digital and analogue magnetic tape, punched paper tape, electric typewriter, direct-writing oscillographic recorders, strip-chart recorders, and visual presentation from both digital and analogue volmeters. Special design and construction techniques necessary for reliable operation under mobile conditions are described.

681.142 : 621.396.933.4

7024 AN EXPERIMENTAL ELECTRONIC DATA PROCESSING SYSTEM FOR AIR TRAFFIC CONTROL.
J.S.MacMullan, H.S.Bray and J.A.Llewellyn.
Proc. Instn Elect. Engrs, Paper 3292 E, publ. July, 1960 [Symposium on data Handling and Display System for Air Traffic Control]. (Vol. 107 B, Suppl. 19, 18-21, 32-5).

Reviews the principal elements and functions of an experimental electronic data processing system for the Oceanic Area Control Centre, and indicates their relation to existing methods of control at the Centre, which are briefly outlined. A stored-programme transistor computer maintains an electronic file of flight progress data on up to 100 aircraft, and is connected to a number of keyboard and teleprinter units for input or output of data and interrogation by controllers. In the interest of flexibility, all functions of the system are specified in detail, and may be changed at will by conventional computer programming techniques. These functions include automatic print-out or flight progress strips and automatic identification of overdue position reports and potentially conflicting flight paths.

681.142

7025 DATA-REDUCTION FOR GUIDED WEAPON TRIALS AT ABERPORTH. A.S.Younger, E.S.Mallett and G.C.Morgan.
Trans Soc. Instrum. Technol., Vol. 12, No. 2, 61-71 (June, 1960).

The general requirements for data-processing at the Ministry of Aviation range at Aberporth are considered. Film-reading and data-handling equipment is described and its suitability is assessed in the light of present and future requirements. Proposals for improved data-processing systems, based on magnetic tape as a primary storage medium, are discussed.

681.142

7026 A HIGH-SPEED PRINTER FOR 3000 WORDS/MIN.
Elektron. Rdsch., Vol. 14, No. 7, 273-5 (July, 1960).
In German.

An instrument which prints directly "en clair" fast information delivered in code from a computer or teleprinter. A series of 72 heads, each furnished with 35 pin electrodes, is mounted in a row over the printing paper to handle a line of script. Under the paper is a corresponding series of 72 flat electrodes. The incoming information, in the form of coded pulses, is fed into selecting circuits which apply negative charges to the appropriate pins of the upper heads to form the corresponding letter or figure. Positive pulses are applied in turn to each of the lower series of electrodes causing charges corresponding to the charged pin positions to be left on the paper. The moving sheet now passes under a reservoir of colour powder which settles on the charged points. Finally the paper passes between a heater and a pressure roller which embeds the powder in the paper surface. H.G.M.Spratt

681.142

7027 A HIGH SPEED DIGITAL DATA LOGGING SYSTEM. H.Fuchs and J.R.Wastell.
Electronic Engng, Vol. 32, 468-72 (Aug., 1960).

Describes a high speed digital-data logging system which has been designed to monitor the outputs from a large number of electric transducers, typically thermocouples, strain gauges, resistance bulb thermometers, pressure transducers, etc. The modules from which such a system is built up are described and their performance discussed. In particular, it outlines the design of a scanning unit capable of switching microvolt signals at fairly high speeds, the design of a data amplifier suitable for discontinuous operation and having extremely low noise and drift and a high speed analogue-to-digital convertor with an accuracy of 0.1% and a decimal output. The system, which is intended for 24 hr operation, incorporates its own automatic checks and is capable of detecting departures form normal operating conditions and producing a complete statement of the conditions at regular intervals of time.

681.142

7028 A METHOD OF PRODUCTION OF HIGH ACCURACY DIGITAL DISCS. J.J.Weaver and E.G.D.Youngs.
Marconi Rev., Vol. 23, 65-84 (2nd Qtr, 1960).

Describes a method for the production of a highly accurate device for the measurement of angular position and to provide this information in a suitable form either for inclusion in a control system or as a straightforward measuring device in a data transmission system.

681.142 : 621.374.32

THE PARAMETRON AND ITS USE IN INFORMATION PROCESSING SYSTEMS. See Abstr. 6771

681.142 : 621.374.32

PARAMETRON COMPUTER CIRCUITS. See Abstr. 6770

681.142 : 621.374.32

REPRESENTATIONS OF SWITCHING FUNCTIONS AND THEIR APPLICATION TO COMPUTERS. See Abstr. 6769

681.142 : 621.374.32

AN IMPROVED FILM CRYOTRON AND ITS APPLICATION TO DIGITAL COMPUTERS. See Abstr. 6782

681.142 : 621.318.12

MAGNETIC CORE MEMORIES. See Abstr. 6678

681.142 : 621.318

MAGNETIC DRUM WITH A ONE MEGABIT STORAGE. See Abstr. 6102

681.142 : 621.395.341.8

DATA PROCESSING FOR TELEPHONE TRAFFIC DISTRIBUTION RECORDING PROJECT. See Abstr. 6340

681.142 : 621.311.1

APPLICATION OF DIGITAL COMPUTERS TO POWER SYSTEM PLANNING. See Abstr. 5948

681.142 : 621.313.3

SYNTHESIS OF INDUCTION MOTOR DESIGNS ON A DIGITAL COMPUTER. See Abstr. 5975

681.142 : 621.316.11

7029 AN A.C. NETWORK ANALYZER WITH CONSTANT-CURRENT GENERATORS AND LOADS.
G.Jungwirth and J.Oberländer.
Siemens-Z., Vol. 34, No. 7, 431-7 (July, 1960). In German.

A description is given of a new a.c. network analyser which operates with constant current instead of with constant voltage as has been the practice until now. The setting of the load distribution is thus considerably facilitated. The problems, in the solution of which, the constant-current a.c. network analyser is superior or at least equivalent to the constant-voltage model are dealt with.

681.142

7030 LIMITATIONS DUE TO NOISE, STABILITY AND COMPONENT TOLERANCE ON THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS BY DIFFERENTIAL ANALYSERS.
M.E.Fisher.
J. Electronics and Control, Vol. 8, No. 2, 113-26 (Feb., 1960).

The solution of partial differential equations by a differential analyser is considered with regard to the effects of noise, computational instability and the deviation of components from their ideal values. It is shown that the "serial" method of solving parabolic, hyperbolic and elliptic equations leads to serious instability which increases as the finite difference interval is reduced. The truncation error (due to the difference approximations) decreases as the interval is made smaller and consequently an "optimal" accuracy is reached when the unstable noise errors match the truncation errors. Evaluation shows that the attainable accuracy is severely limited especially for hyperbolic and elliptic equations. The "parallel" method is stable when applied to parabolic and hyperbolic (but not elliptic) equations and the attainable accuracy is then limited by the accumulation of component tolerances. Quantitative investigation shows how reasonably high accuracy can be achieved with a minimum of precise adjustments.

681.142

7031 SYSTEMATIC SCALING FOR DIGITAL DIFFERENTIAL ANALYZERS. A.Gill.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 4, 486-9 (Dec., 1959).

The usefulness of the large-capacity digital differential analyser (D.D.A.) is severely hampered by the complexity of the scaling process. The scales needed for programming have to be compatible with the so-called "equilibrium", "topological", and "boundary" constraints, imposed by the construction of the analyser and the nature of the problem at hand. Simultaneous trial-and-error satisfaction of all these constraints, to achieve optimal range and accuracy of computation, is practically impossible for any problem involving more than a few integrators. It is shown how the scaling constraints can be organized in a matrix form, and how optimal scales can be produced in a systematic manner. The proposed scheme, which can be programmed for automatic execution, is adaptable for D.D.A's operating in conjunction with general-purpose digital computers.

681.142

7032 THE ANALOGUE INTERPOLATOR.
T.Erismann.
Z. angew. Math. Phys., Vol. 10, No. 4, 339-47 (1959). In German.

A new method for transforming digital data tables into continuous shaft rotations is given. The method is characterized by a special type of parabolic interpolation incorporated into the analogue part of the machine and conceived in a way to allow for perfect stability and smoothness of output. Formulae are given for predetermining the errors of the system for interpolating any desired function.

681.142

7033 A 2-CHANNEL DATA LINK FOR COMBINED ANALOG–DIGITAL SIMULATION. J.Greenstein.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 40-4 (1960) = Commun. and Electronics, No. 47 (March, 1960).

The speed of analogue and the accuracy of digital computers may be combined to advantage in the real-time simulation of systems which themselves involve the use of the two techniques. The general mode of operation is described of a single bidirectional data link for this purpose. Speeds of sampling of the analogue computer outputs of up to 4000 per sec were employed. A number of advantages are claimed for the system, in particular that modifications to the simulation programme, eventually destined to be incorporated in the digital equipment, may initially be tried out with much less trouble on the analogue section. A missile system is mentioned as one application. G.H.Stearman

681.142

7034 PROCEDURE FOR DESIGNING RECIPROCAL COMPUTER CIRCUITS. A.Gill.
Electronics, Vol. 33, No. 21, 92-3 (May 20, 1960).

Formulae are discussed for diode linear-approximation circuits which give a hyperbolic characteristic. Practical considerations such as suitable resistance values and biasing arrangements are included. K.C.Garner

681.142

7035 THE ANALOGUE COMPUTER UTAC.
C.P.Gilbert, R.M.Duffy and T.Giucharoff.
J. Instn Engrs Australia, Vol. 32, No. 1-2, 11-17 (Jan.-Feb., 1960).

A general description of the first section of UTAC, an electronic analogue computer designed for university and industrial research. At present UTAC contains 24 amplifiers of a type having low drift and good high-frequency response. Flexibility of operation is achieved by allowing any amplifier to perform any operation, either linear or non-linear, and this is facilitated by the use of plug-in computing components. A method of amplifier control which allows all normal modes of operation and employs only one relay per amplifier is described. The flexibility is enhanced by allowing a timing unit, or variables in the computation, to operate the control relays. A simple system of overall calibration making use of comparative measurements of voltage and time allows individual computing units to be calibrated to an accuracy of 0.1%. A new type of generator for producing voltages which are arbitrary functions of time is also briefly described.

681.142

7036 THE MINIMIZATION OF THE EFFECT OF DRIFT IN D.C. ANALOGUE COMPUTERS.
E.T.Emms and K.H.Brinkmann.
Electronic Engng, Vol. 32, 550-3 (Sept., 1960).

The effects of d.c. amplifier drift on d.c. analogue computers are explained, and methods of choosing scaling factors and apportioning gains to minimize these effects are given. A number of guidance rules are formulated.

681.142

7037 SOLUTION WITH AN ANALOGUE ELECTRONIC MACHINE OF TWO DIFFERENTIAL EQUATIONS LINKED BY BOUNDARY CONDITIONS. M.Vaivars.
Latv. PSR Zinat. Akad. Vestis, No. 2(151), 51-6 (1960). In Russian.

During each cycle of applied voltage, a bridge rectifier works in two regimes in which two and four elements respectively conduct. Each regime is represented by a linear differential equation. At certain instants of time, the regime changes, the initial conditions of the ensuing phase being set by the final state of its predecessor. The system can be represented in analogue form by two amplifier networks linked by an automatic switching device. The predictions of the analogue are confirmed by measurements made on an actual rectifier. A.E.I. Research Laboratory

681.142 : 518

7038 ELECTRONIC DEVICES FOR ANALOGUE MULTIPLICATION AND DIVISION OF EXPONENTIAL FUNCTIONS. G.Stainov, A.Dershanski, and M.Dimitrova.
C.R. Acad. Bulg. Sci., Vol. 11, No. 6, 465-8 (Nov.-Dec., 1958). In Russian.

Circuits are described for analogue multiplication of two or more exponential functions using thermionic valves. Division is performed on similar circuits. The accuracy of operation is found to be better than 2%. A.Woroncow

681.142

7039 ELECTRO-MECHANICAL CALCULATING MACHINE "INTEGRAL 1" FOR THE INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS. V.I.Loskutov.
Priborostroenie, 1959, No. 9. In Russian. English translation in: Instrum. Constr., 1959, No. 9, 1-5 (Sept.).

Descriptions of the principles employed are given. The particular interest lies in the punched-tape setting-up of the initial values, the storage units, and typewritten presentation of the results, in addition to the more usual graphical read-out. Solutions are considered to be accurate to 0.01%. K.C.Garner

681.142

7040 DIFFERENTIATING AND INTEGRATING CIRCUITS WITH POSITIVE OPERATIONAL FEEDBACK. A.I.Petrenko.
J. Electronics and Control, Vol. 8, No. 1, 59-66 (Jan., 1960).

A general method of analysis and design is presented and illustrated by a particular circuit. A possibility of removing the influence of the internal impedance of the signal source on the accuracy of performing the mathematical operation is shown.

681.142

7041 THE GENERATION OF SQUARES WITH THE USE OF NONLINEAR RESISTORS. E.Grosswald.
I.R.E. Trans Circuit Theory, Vol. CT-6, No. 4, 334-9 (Dec., 1959).

Whenever great accuracy is not required, a convenient way to obtain squares, and hence, to multiply, in analogue computers is by the use of nonlinear resistors, especially thyrite rods, in certain circuits. These circuits are usually determined, more or less empirically, by starting from schemes that have given good results in the past and modifying them, or by varying the numerical values of the resistors used, until "best" results are obtained. The concept of "best" results is clarified. Furthermore, it is shown that, regardless of the complexity of the circuit, the input–output characteristic depends only on two parameters. An explicit method is given by which the numerical values of the resistors used in the thyrite circuit can be computed for the given characteristics of the thyrite rod used in order to achieve desired "best" results.

681.142

7042 ELECTROMECHANICAL ANALOGUE COMPUTER FOR SOLVING TRIGONOMETRICAL PROBLEMS. E.Hölscher.
Elektrotech. Z. (E.T.Z.)A, Vol. 81, No. 11, 387-92 (May 23, 1960). In German.

A discussion on the application of synchro resolvers and a.c. servomechanisms to axis transformation and course plotting problems, with diagrams of simple systems. The accuracy of the components is considered in some detail. K.C.Garner

681.142

7043 THE GENERATION OF FOURIER TRANSFORMS AND COEFFICIENTS ON AN ANALOGUE COMPUTER. F.C.Harbert.
Electronic Engng, Vol. 32, 496-8 (Aug., 1960).

Two computer arrangements are described for obtaining the Fourier transform of a function of time; one requiring computing amplifiers and multipliers, the other computing amplifiers only. A method is described for obtaining on an analogue computer the frequency response of a physical system once its response to a step input is known. This technique is illustrated by an example. An extension of the computer arrangements permits the extraction of Fourier coefficients from a periodic waveform.

681.142

7044 THE CORRECTION OF ERRORS IN POTENTIOMETER FUNCTION GENERATORS. J.Merchant.
Electronic Engng, Vol. 32, 493-6 (Aug., 1960).

A method is described of correcting the various errors that can occur in potentiometer function generators due to arm loading and other practical limitations. The errors caused by approximating to a continuous function with line segments are not considered. In the method, the potentiometer is loaded with resistors calculated in the most simple way, to give the required line segment function. The resulting function is measured, and its deviations from the design objective used to calculate a set of correcting conductances for the potentiometer segments. The potentiometer, modified with these conductances will now give a function much nearer the design objective. A second application of the method may be made to improve still further the function accuracy, but in many cases one correction process will be sufficient.

681.142

7045 A TWO-VARIABLES FUNCTION GENERATOR. J.Gonzales-Ibeas and V.Aleixandre.
Ann. Assoc. Internat. Calcul Analogique, Vol. 2, No. 1, 5-12 (Jan., 1960).

A two-variables function generator using a cathode-ray tube and photomultiplier is described. The spot coordinates on the screen are made proportional to the input variables. An optical system projects the spot on a flat function plate and the photomultiplier picks up the light that goes through the function plate. The main features of the generator are to plot the function by means of level lines and to move the scanning spot as slowly as the input variables, without any sweep. Each time the spot goes through a level line, a positive pulse must be obtained if the level increases, and a negative one if the level decreases. The function plate has three darkening degrees that correspond to three different values at the photocell output. With these three kinds of output values sufficient information is obtained for knowing not only when there is a change of level, but the sign of such a change. A switching system converts the photocell output into positive and negative pulses necessary for obtaining the function value continuously.

681.142

7046 AN ANALOGUE METHOD OF APPROXIMATION. J.Paquet.
Cables et Transm., Vol. 13, No. 3, 195-9 (July, 1959). In French.

Discusses the approximation of a given function by a second function whose value depends on a number of parameters which are to be determined such that the mean quadratic error is minimized. The values of the parameters are found using a suitable analogue impedance network — an extension of the analogue technique familiar for the solution of systems of linear equations. The method has been applied to a problem concerning the impedance of a dipole. G.D.Sims

681.142

7047 AN ANALOGUE COMPUTER FOR INVESTIGATING THE DIRECTIVITY CHARACTERISTICS OF COMPLEX ARRAYS OF UNIT AERIALS. G.Mitchell.
Post Off. elect. Engrs' J., Vol. 52, Pt 4, 246-50 (Jan., 1960).

This analogue computer was designed to perform automatically the necessary computations for any array with from 50 to 200 unit aerials, in which the aerials are arranged along from one to sixteen diametral rows intersecting at a common point, and with a maximum of 14 aerials in any one diametral row. The computer can also be used on a semi-automatic basis for dealing with larger or more complex arrays.

681.142 : 621.317.7

7048 PHOTOELECTRONIC CHART READER OF RECORDED INK LINE. H.Yuhara, K.Nakajima, S.Koizumi, Y.Nakamura and Y.Endou.
J. Radio Res. Lab. (Tokyo), Vol. 6, No. 28, 705-19 (Oct., 1959).

The apparatus automatically scans the recorded line on a strip chart, produces an equivalent analogue signal (current or voltage) and corrects the signal by a linearizing device for any departure from linearity in the original recording. The chart is scanned by a photoelectric optical system (50 cd lamp and CdS photoconductive cell). The light-spot on the paper is 0.3 mm in diam., and it moves across the chart in an arc identical with that of the recording pen. The scanning arm is cyclically deflected and returned to zero at 1 c/s by a synchronous motor-driven cam. A colour filter is built into the optical system so that the CdS cell is sensitive to red or black ink lines, but is insensitive to the printed coordinates which are green or light blue. Four chart speeds of 5, 10, 20 and 60 mm/min are provided. The linearizing device is a flexible cam with 60 adjusting screws which rocks the stator of a rotating-vane variable capacitor. The capacitor forms part of the analogue signal electronic circuits. Both cam and capacitor rotor are rotated by the synchronous motor. The max. range of linearization is ±10% of full scale reading. The analogue signal circuits contain a capacitor which is charged and discharged every normal scanning cycle; if there is a short break in the inked trace on the chart, the last signal is stored in the capacitor. The max. analogue output voltage is +38 V, and the max. current 5 mA. The max. error is stated to be ±0.5% of f.s.r. C.F.Pizzey

681.142

7049 FREQUENCY-TO-PERIOD-TO-ANALOG COMPUTER FOR FLOWRATE MEASUREMENT. T.W.Berwin.
I.R.E. Trans Electronic Comput., Vol. EC-9, No. 1, 62-71 (March, 1960).

This apparatus is a special purpose nonlinear analogue computer which accepts an a.c. voltage of varying frequency, acts upon the period of each cycle, computes the inverse of the time period, e = 1/T, and holds the information for the period of the next cycle. Thus, the output voltage is a level which is proportional to the input frequency f = 1/T computed once for every cycle. The system is accurate to better than ±0.5% of 2/3 full scale. Application of the computer is described and results presented for fast readout and recording of gas and liquid turbine type flowmeters. Extensions of the circuits used can produce voltages proportional to ln t or $1/t^2$, for time t greater than a small positive number.

681.142 : 531.22

7050 USE OF AN ELECTRICAL ANALOGUE FOR THE SOLUTION OF A VARIETY OF TORSION PROBLEMS.
S.C.Redshaw.
Brit. J. appl. Phys., Vol. 11, No. 10, 461-8 (Oct., 1960).

A brief review of Saint-Venant torsion theory is given and the advantages and disadvantages of the various forms in which the equations can be expressed are discussed in relation to electrical analogue computation. It is shown how, by the use of a simple passive resistance network, solutions can easily be obtained both for simply connected regions as well as for the analytically difficult problem of multiply connected regions. Examples of the application of the electrical-analogue method to the problems of plastic torsion, the torsion of compound bars, thick hollow sections and thin-walled sections filled with a dissimilar material, are given.

681.142 : 518

7051 APPARATUS FOR THE STUDY OF ALGORITHMS OF ROAD TRAFFIC MOVEMENT.
S.V.Yablonskiĭ, A.M.Gil'man, I.V.Kotel'nikov and P.M.Potylitsyn.
Dokl. Akad. Nauk SSSR, Vol. 132, No. 1, 78-81 (May 1, 1960).
In Russian.

A description of a model which was constructed to represent a simple crossroads, i.e. an intersection of two two-way roads, controlled by four-colour traffic lights. Eight lanes (of left-turning and straight-through vehicles, right-turns not being controlled) approaching the crossing, are represented by eight generators of either random pulses or pulses from punched tape taken from an actual crossroads. The "vehicles" are counted by eight four-stage reversible binary counters. A computer can be set for various requirements, such as minimum waiting time of vehicles, etc. Operation of the model is displayed on a lighted panel. F.Quelon

681.142

7052 INDUSTRIAL COMPUTERS FOR TANK FARM INVENTORY CONTROL AND DATA HANDLING.
E.B.Turner and R.J.Noorda.
Elect. Engng, Vol. 79, No. 5, 390-3 (May, 1960).

A general discussion of the possibilities of on-line computor operation in a tank farm is related to a typical installation of 150 tanks. The information available is: tank level height; tank temperature; product identity; integrated flow; and basic sediment and water. This has to be processed to yield such information as: summary of a given shipper's specific product; summary of tank volume remaining or tank volume available in all tanks of a given shipper's product; a search to determine which tank has sufficient of a specific product available for a given delivery. There is a discussion of the means of simulating a tank volume curve and some general discussion which leads to the conclusion that for the operation considered, 8000 words of storage, expandable to 16 000 would be required. G.A.Montgomerie

681.142

7053 A DISPLAY UNIT FOR A FLIGHT SIMULATOR.
A.G.Barnes and W.F.Coulshed.
Electronic Engng, Vol. 32, 402-7 (July, 1960).

A visual representation of the ground is presented to the pilot on a c.r.t. in the simulator cockpit. This display, based on the "contact analogue" type of presentation was developed with the particular requirements of the flight simulator in mind. The design limitations and electronic techniques used in generating the display are described, together with a short account of the display in use.

MECHANICAL AND CIVIL ENGINEERING TECHNOLOGY

MATERIALS . TESTING

620.179

7054 CREEP OF STRAIN GAUGES UNDER STATIC TENSILE LOAD. II-III. C.Rohrbach and N.Czaika.
Arch. tech. Messen, No. 289 (Ref. J 135-17), 35-8 (Feb.); No. 290 (Ref. J 135-18), 55-6 (March, 1960). In German.

For Pt I, see Abstr. 4809 of 1960. The dependence of creep on the length of a gauge, the thickness of the strip, the mechanical properties of the strip and the properties of the adhesive, all at various temperatures, is shown in numerous curves. C.F.Pizzey

620.179.14

7055 AN EDDY-CURRENT FLAW DETECTOR. E.Ruff.
Electronic Engng, Vol. 32, 480-3 (Aug., 1960).

Examination of airframe bolt-holes for cracks requires a quick non-destructive method. An instrument using the effect on an inductance of a broken shorted turn is described and some other related applications are given.

620.179.14

7056 ELECTROMAGNETIC FAULT DETECTION ON NON-FERROUS PIPES. P.Graneau and S.A.Swann.
J. Electronics and Control, Vol. 8, No. 2, 127-47 (Feb., 1960).

The development of electromagnetic tests for pipes has in the past been based on time-consuming trial-and-error experiments for establishing the best combination of the three variables: energizing frequency, coil geometry and adjustment of phase suppression. Theoretical predictions become possible when the current distribution in the pipe is known. A simplified model, consisting of a circular thin shell (pipe) surrounded by a co-axial current circle (short coil), permits calculation of the current distribution to a sufficient degree of accuracy. An experiment is then described proving that, up to a certain test frequency, an actual pipe behaves like a shell with uniform current penetration. The new approach to electromagnetic pipe testing shows how to exploit the advantage of running inspection by virtue of the short signal pulse derived from a defect travelling through the coil system, which distinguishes localized faults from gradual changes in pipe dimensions and other physical properties. Tests can be made independent of unbalanced dynamically induced currents, the only disadvantage that could arise from movement of the test object.

620.179.16

7057 THE EVALUATION OF BOND QUALITY IN HONEYCOMB PANELS USING ULTRASONIC SURFACE WAVE TECHNIQUES. E.T.Hughes and E.B.Burstein.
Nondestr. Test., Vol. 17, No. 6, 373-7 (Nov.-Dec., 1959).

The basic honeycomb sandwich consists of a honeycomb core fabricated from aluminium, copper, stainless steel or plastic, confined between two face panels, usually aluminium, titanium or plastic. Such a structure has a strength many times stronger than that of a normal structure of equal weight, provided the bond between the honeycomb and face panels is satisfactory. When surface waves at ultrasonic frequencies are induced in a material, the energy decreases rapidly with depth below the surface to a depth of about 1 wavelength. When a sheet less than ½ wavelength thick is tested in this way, attenuation increases in proportion to the amount of additional material attached to the underside of the sheet and this technique has been developed into a test on the quality of the bond between a honeycomb and face panel. A transmitter and a detector are placed together on the surface of the panel and the combined search unit is moved over the panel in 1 in. steps. The amplitude of the received signal is examined on an oscilloscope and divided into four arbitrary ranges indicating the quality of the bond.

A.C.Whiffin

620.179.16

7058 INVESTIGATION OF RESIDUAL STRESS IN FERROMAGNETICS USING ULTRASONICS. W.J.Bratina and D.Mills.
Nordestr. Test., Vol. 16, No. 2, 110-13 (March-April, 1960).

The technique is based on the hypothesis that the absorption of mechanical vibrations in a metal at ultrasonic frequencies depends on the stress in the material. Tests were made at about 3 Mc/s and cylindrical specimens subjected to tension were tested by ultrasonic pulses injected at one end. The relative attenuation of annealed material decreased with increase of stress, while that in initially deformed material rose to a peak and then decreased again, the height and position of the peak depending on the initial deformation. Similar curves were obtained when specimens of this material were subjected to an external magnetic field instead of to direct tension. It was concluded the technique might be developed into a non-destructive method of determining residual microstresses.

A.C.Whiffin

WELDING . SOLDERING

621.791.73

7059 NEW HIGH-SPEED WELDING PROCESS FOR THERMOPLASTICS. G.Haim.
Kunststoffe, Vol. 50, No. 4, 255-6 (April, 1960). In German.

An electrically heated manual welding torch is described in which the heating coils are embedded in ceramic material. Special nozzles simplify the welding process and enable higher welding speeds to be reached. The process is suitable for use in conjunction with rigid and flexible P.V.C., polyethylene and polypropylene.

621.791.75

7060 FUSION WELDING OF BERYLLIUM. T.J.McDonald, N.F.Eaton and D.B.Wright.
Brit. Weld. J., Vol. 7, No. 7, 441-50 (July, 1960).

Apparatus is described for experimental tungsten-arc inert-gas autogenous fusion welding of beryllium. Satisfactory welding conditions were obtained for a variety of weld designs of beryllium fabricated from ingot and sintered powder material. Work was concentrated on fuel element end-cap designs where weld preheat and subsequent cooling rate were found to be critical factors in eliminating cracking when using flowing argon as an inert-gas shield. Welding in a static, pure argon atmosphere was found to require less critical control of these factors.

LIST OF JOURNALS

The following list supplements the List of Journals published with the Index to Volume 62 (1959). Reprints of the List of Journals can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free. The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

A.E.I. Res. Lab. Repr.	A.E.I. Research Laboratory Reprint (Formerly: British Thomson-Houston Research Laboratory Publication) Associated Electrical Industries, Rugby.
Automat. remote Control.	Automation and Remote Control Instrument Society of America, 313 Sixth Avenue, Pittsburgh 22, Pennsylvania. (A translation of the journal Avtomatika i Telemekhanika of the Academy of Sciences of the USSR. [Avtomat. i Telemekh.])
Instrum. exper. Tech.	Instruments and Experimental Techniques Instrument Society of America, 313 Sixth Avenue, Pittsburgh 22, Pennsylvania. (A translation of the journal Pribory i Tekhnika Eksperimenta of the Academy of Sciences of the USSR. [Pribory i Tekh. Eksper.])
Soviet Physics—Solid State (New York)	Soviet Physics—Solid State American Institute of Physics, 335 East 45th Street, New York 17, N.Y. (A translation of Fizika Tverdogo Tela [Fiz. tverdogo Tela])

NEW JOURNAL

Quart. J. Roy. Astron. Soc.	Quarterly Journal of the Royal Astronomical Society (Successor to: Occasional Notes of the Royal Astronomical Society) Royal Astronomical Society, Burlington House, London, W.1. Vol. 1, No. 1, dated September, 1960.

CHANGE OF TITLE

B.T.-H. Res. Lab. Publ.	British Thomson-Houston Research Laboratory Publication Title changed to: A.E.I. Research Laboratory Reprint [A.E.I. Res. Lab. Repr.] in 1960
Occ. Notes Roy. Astron. Soc.	Occasional Notes of the Royal Astronomical Society. Succeeded by: Quarterly Journal of the Royal Astronomical Society [Quart. J. Roy. Astron. Soc.]

ERRATA

Abstr. 150 (1960) line 4: for "399-408" read "409-18".
Abstr. 3297 (1960) line 4: for "Yu.Birzvalks" read "Yu.Birzvalk".
Abstr. 5302 (1960) line 4: for "Trans" read "Proc".
Abstr. 5637 (1960) line 7: for "conductive" read "conducive".
Abstr. 5641 (1960) line 6: insert "insufficient to cause oscillation and the amount of delay" after "the degree of feed-back being".
Abstr. 5722 (1960) line 1: for "ELECTRIC" read "ELECTRONIC";
line 5: for "bands" read "boards".
Abstr. 5748 (1960) line 7: for "amplifier" read "amplifiers".

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